RCRA Facility Investigation

Quality Assurance Project Plan

Prepared for

The Hoover Company

Voluntary Corrective Action Program
Plant 1, North Canton, OH

February 2000

CH2MHILL

RCRA Facility Investigation

Quality Assurance Project Plan

Submitted to

The Hoover Company

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QUALITY ASSURANCE PROJECT PLAN FOR THE RCRA FACILITY INVESTIGATION AT THE HOOVER COMPANY-NORTH CANTON FACILITY USEPA ID NUMBER OHD004462131 REVISION 0

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Acronyms and Abbreviations

BOD	biological oxygen demand
COC	chain of custody
COD	chemical oxygen demand
DQOs	data quality objectives
EB	equipment blank
FTL	field team leader
GC	gas chromatography
ID	identification number
LC	liquid chromatography
LNAPL	light nonaqueous phase liquids
LOE	level of effort
MDL	method detection limit
MS	mass spectroscopy
MS/MSD	matrix spike/matrix spike duplicate
PAHs	polyaromatic hydrocarbons
PCBs	polychlorinated biphenyls
PRP	potentially responsible party
QA	quality assurance
QA/QC	quality assurance/quality control
QAP	quality assurance plan
QAPP	quality assurance project plan
QC	quality control
RCRA	Resource Conservation and Recovery Act of 1976
RD	remedial design
RFI	RCRA Facility Investigation
RL	reporting limit
ROD	record of decision
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SOPs	standard operating procedures
SQL	structured query language
SVOCs	semivolatile organic compounds
SW	solid waste
TAL	Target Analyte List
TOC	total organic carbon
USEPA	United States Environmental Protection Agency
VOCs	volatile organic compounds

1. Project Description

This QAPP presents the organization, objectives, planned activities, and specific Quality Assurance/Quality Control (QA/QC) procedures associated with the RCRA Facility Investigation (RFI) for The Hoover Company in North Canton, Ohio. This work is being completed in response to the October 28, 1999, Voluntary Corrective Action Agreement between The Hoover Company and the USEPA. Specific protocols for sampling, sample handling and storage, chain-of-custody, and laboratory and field analyses will be described. The QA/QC procedures will be structured in accordance with applicable technical standards, USEPA's requirements, regulations, guidance, and technical standards. This QAPP has been prepared in accordance with the USEPA Region V QAPP policy as presented in USEPA *Region V RCRA QAPP Instructions (April 1998)* and other relevant guidance documents.

1.1 Introduction

This QAPP has been prepared for The Hoover Company by CH2M HILL. A Sampling and Analysis Plan (SAP), a QAPP, a Data Management Plan, and a Health and Safety Plan have been completed in support of the RFI Work Plan.

1.1.1 Overall Project Objectives and Decision Statements

The following critical success factors describe the overall objectives for the Project:

- Acceptance of the completion of RCRA closure/corrective action obligation by the federal and state environmental agencies by meeting the intent of the Agreement and the state and federal RCRA regulations
- Maintenance of a safe, healthy working environment for field and office staff for working environments under CH2M HILL's control
- Development of remedial systems, where necessary, that effectively and efficiently meet the objectives of the Agreement and are protective of human health and the environment

The object of the RFI is to gain a better understanding of physical and environmental quality conditions at the facility. Physical and chemical data will be collected during the investigation with the following objectives:

- Identify whether potentially site-related constituents are present in the soil or groundwater at the facility boundary, and if present, determine constituent concentration distribution
- Provide data that will allow an assessment of potential constituent migration and support an analysis of potential risks to human health or the environment
- Identify and prioritize areas where additional onsite or offsite nature and extent characterization is warranted to determine whether migration has occurred

Specific data quality objectives for field and laboratory data collection are discussed in detail in Appendix A of the SAP, and summarized in Section 1.4 of this QAPP.

1.1.2 Project Status/Phase

The Hoover Company and CH2M HILL will utilize an integrated and phased approach for the RFI. During the RFI, data collection will be conducted in phases, with the results being determining factors in decisions regarding the necessity for additional phases of investigation, or a human health baseline risk assessment or a preliminary ecological risk assessment.

The Phase I field investigation will include the following activities:

- **Soil,** which comprises both surface soil (0 to 24 inches below ground) and subsurface soil (greater than 24 inches below ground)
- **Groundwater,** which comprises all water collected below ground surface
-

Soil and groundwater samples will generally be analyzed for compounds selected from the RCRA Appendix IX list of compounds. The selected target analytes, the numbers, and distribution of samples will be specified in the Work Plan, the SAP and in Section 7 of this QAPP.

Hexachlorophene is the only Appendix IX compound that will not be analyzed. Hexachlorophene cannot be consistently analyzed successfully. The planned sampling locations, the rationale for their selection, and analytical parameters to be determined at each location are described in the project-specific SAP. Field conditions may cause the exact sample locations and total number of samples to change.

Data from the RFI will be qualitatively and statistically evaluated to determine whether an additional investigation is necessary. If the RFI data suggests that sufficient site characterization information has been collected, The Hoover Company will use this information to access if further action(s) are needed for the site.

Field activities and findings will be summarized in a Field Investigation Report. The Final Field Investigation Report will be submitted to Hoover, USEPA, and Ohio EPA and placed in the public record.

1.1.3 QAPP Preparation Guidelines

This QAPP has been prepared in accordance with the USEPA *Region V RCRA QAPP Instructions.*

1.2 Site/Facility Description

A brief description of the facility, its geological setting, and associated features is presented in the section below.

1.2.1 Location

Hoover Plant 1 is located in a mixed residential, commercial, and industrial area near the center of North Canton in Stark County, Ohio (Figure 1-1). The manufacturing and warehouse space encompasses 24.6 acres of the 86.6-acre facility.

The facility can be divided into two primary active areas, based on current and historic uses: the North Yard and the Plant Area (Figure 1-2). Most of the current and historic chemical and waste management and treatment practices occurred in the North Yard. The Plant Area contains most of the manufacturing processes. Access to manufacturing buildings in the Plant Area and exterior materials management areas in the North Yard is controlled by fences and locked structures that surround the exterior parts of the site.

The public has access to some parking lots on, and to public streets that cross Hoover property. There is also public access to baseball diamonds located in the northernmost part of the facility. There is limited public access to soccer and practice football fields, also located in the northernmost part of the facility.

1.2.2 Facility/Site Size and Borders

This information is provided in Section 2, Facility Background of the RFI Work plan. The facility size and borders can be seen in Figure 1-2.

1.2.3 Topography

See Section 2.4.1of the RFI Work plan for information concerning the site's general topography.

1.2.4 Local Geology and Hydrogeology

See Section 2.4 of the RFI Work plan for information concerning the site's physical features, population and land use, geology and soil, groundwater resources, and surface hydrology and drainage (i.e., receiving watershed).

1.2.5 Surrounding Land Use

The plant is bordered to the north by residences and North Canton Hoover High School; to the east by the high school football field and residences; to the south by residences and the local YMCA; and to the west by commercial establishments and residences. North Canton Hoover High School is located about 1,000 feet north of plant operating areas, across 7th Street. Several public streets divide the facility (namely Orchard, Charlotte, Hower, Witwer, and East Maple streets).

1.2.6 Ecological Communities and Habitats

Although little ecological activity (limited to ducks lighting on the wastewater solids settling ponds) has been observed onsite to date, an ecological evaluation will be conducted as part of the RFI. The evaluation will be performed to verify the presence or absence of habitat, ecological receptors, or potential exposure pathways at the facility.

1.3 Site/Facility History

1.3.1 General History

Hoover has owned the property on which the Plant Area is located since 1873. In 1921, Hoover purchased the area between Hower and 7th Street, including the North Yard. Hoover originally manufactured leather goods and had a tannery on the property. Between 1907 and 1918, both electric sweepers and leather goods were manufactured onsite. Before World War II, Hoover manufactured electric sweepers, household appliances, and other miscellaneous items. Commercial manufacturing was interrupted during the war in support of the war effort. Soon after the war, the plant began manufacturing toaster ovens, coffeepots, hand mixers, and electric and steam irons. Current operations mainly consist of compression and extrusion molding of plastic parts, motor and hose manufacturing, and assembly of vacuum cleaners, polishers, and service parts. More detailed information regarding historical manufacturing operations is presented in the Material and Waste Management Areas Inventory, Hoover Plant 1, North Canton, Ohio (CH2M HILL 1997).

Most of the chemicals/regulated process wastes associated with past operations at the plant have been wastewater and wastewater treatment sludges. Other wastes included plating sludge, used oil, and small quantities of spent solvents. Detailed records of waste management and handling before the 1970s do not exist.

Based on the information available, liquid process wastes were discharged to the storm sewer before the mid-1930s, a common practice at the time. Starting in the mid-1930s and through 1944, liquid wastes were discharged to the sewers. In 1944, Hoover constructed the first onsite wastewater treatment pond. Wastewater was routed to wastewater treatment ponds for settling, pH adjustment, and oil and solids removal. Between 1944 and 1980, the oxidation of cyanide and metals occurred in the plant and the wastewater was discharged to the ponds. Treated wastewater is now discharged to the storm sewer that leads to an unnamed tributary of Nimishillen Creek and is regulated by the plant's NPDES permit (CH2M HILL 1997).

Solid waste management practices at the plant have consisted of both offsite and onsite land disposal. Based on a review of aerial photographs, it appears that onsite land disposal began as early as the mid-1930s. It is believed that wastes were disposed of in natural onsite low-lying areas until 1968. The wastes consisted of wastewater treatment sludge from plating operations and spent halogenated and nonhalogenated degreasing solvents. Small quantities of paint solvents and cyanide salts from heat treating operations may have also been disposed of onsite. Since the early 1970s, sludge has been disposed of offsite at an appropriately permitted facility. Details about historic waste management and specific areas at the site where these practices occurred are identified and listed in the Material and Waste Management Areas Inventory. Approximate locations and boundaries of these areas are illustrated on Figure 1-3.

In general, there have been few recordable releases. Limited soil removal has been performed in response to releases documented at two areas: the former drum storage area (referred to as the Regulated Unit), where 15 cubic feet of soil was removed in 1987 after three drums were observed to be leaking; and the former hydraulic oil tank farm, where a

quantity of soil was removed in 1992 when the aboveground storage tanks were removed (CH2M HILL 1997).

1.3.2 Past Data Collection Activities

Environmental sampling data available for the Hoover site have focused on some general site conditions and the area around the Regulated Unit. The primary source of information regarding current environmental conditions at the facility is the recent Regulated Unit investigation work, documented in the Technical Memorandum: *Regulated Unit Geoprobe Soil and Groundwater Sampling for The Hoover Company, North Canton, Ohio, May 26, 1999* (CH2M HILL 1999a). More limited sampling was performed around the Regulated Unit in 1988 (Floyd Brown Associates 1988). Data from the earlier investigation work were incorporated into the more recent report (CH2M HILL 1999a).

As part of that investigation work (CH2M HILL 1999a), soil samples were collected from 75 boring locations and groundwater samples were collected from 37 locations in and around the Regulated Unit. Twelve monitoring wells are within and surrounding the Regulated Unit and have been monitored for groundwater quality and groundwater levels. Seven piezometers were installed around the perimeter of the facility to better understand the site groundwater flow conditions. Groundwater quality samples have not been collected from the piezometers.

Soil and groundwater sampling results indicate that some of the constituents of interest stored at the Regulated Unit may have been released to the environment. The occurrence of phthalates, toluene, ethylbenzene, xylenes, chlorinated VOCs (principally tetrachloroethylene and its degradation products), and metals has been documented in soil and groundwater beneath and outside the boundaries of the Regulated Unit (CH2M HILL 1999a). It is not yet known if the metals or organic compounds are present at concentrations above facility-specific target screening or cleanup levels which will be developed as part of this phase of the work.

1.3.3 Current Conditions

Three areas previously identified through CERLCA or RCRA listings and identified in the Material and Waste Management Areas Inventory relevant to this perimeter investigation include: Site A, Site B, and the Regulated Unit (Figure 1-3).

Site A is a CERCLA-listed site that is an oval shaped former land disposal area (believed to be about 0.8 acre) located along the western boundary of the facility. Between roughly 1920 and 1948, wastes such as enameling and powerhouse sludges, drums, and miscellaneous off-specification products (such as WWII helmet liners) were disposed of in this area. Site A was regraded and paved for use as a parking area by 1958.

Site B is a CERCLA-listed site that is an irregularly-shaped former land disposal area (roughly 4.5 acres) in what was once the northeastern corner of the facility, along the existing property boundary. Between 1948 and 1968, dredged sludge from the wastewater treatment ponds were placed in the area. Site B is covered with clean fill and paved as a parking area.

The Regulated Unit is a RCRA-regulated former drum storage area under interim status located in the North Yard. It is an outdoor, open, uncovered flat area. The unit was used

from 1930 as a general storage area and as an interim status hazardous waste storage area from 1980 until July 1989. Waste managed in the area included spent solvents, spent methylene chloride, spent paint wastes, metal-containing wastes, electroplating wastewater treatment sludge, and waste containing the plasticizer bis(2-ethylhexyl)phthalate. Since July 1989 when Hoover submitted a closure plan to Ohio EPA, Hoover has investigated the soils and groundwater at and surrounding the Unit. The environmental quality information collected since 1989 at the unit was used as the basis to identify sampling approaches and data quality objectives for this perimeter investigation.

1.4 Project Objectives and Intended Data Usages

The project objectives and data quality objectives are provided in Section 3, Project Approach of the RFI Work plan, and Appendix A of the SAP, respectively. This information has been incorporated into this QAPP by reference.

1.4.1 Project Target Parameters

A focused Target Analyte List (TAL) will be used for the investigation of 80 percent of the samples analyzed. The focused TAL was developed based on investigation-specific Data Quality Objectives (DQOs). The focused TAL is composed of compounds from the Appendix IX analytical suite but usually will not include all of the compounds within a given analytical suite.

Analyses for the full list of compounds identified under RCRA Appendix IX (40 CFR 261), will be performed at 20 percent of the locations to confirm that the TAL accurately reflects the primary constituents of interest. The locations for the samples to be analyzed for the full Appendix IX list of compounds are evenly spread (every fifth sample location) across the RFI sample locations. These locations are summarized on Figure 1-4.

1.4.2 Field Parameters

The Field Parameters are discussed in Section 7.1 of this QAPP. The field groundwater field parameters include reduction potential, dissolved oxygen, conductivity, temperature, and pH in order to access onsite and offsite groundwater chemistry.

1.4.3 Laboratory Parameters

The project target parameters are the Appendix IX list or a subset of the Appendix IX list:

- Volatile organic compounds (method SW-846 8260B)
- Semivolatile organic compounds (method SW-846 8270C and 8141)
- Low level PAHs (method SW-846SIM)
- Metals (SW-846 6010B, 9012A, and 7000 series methods)
- Polychlorinated biphenyls (method SW-846 8082)
- Pesticides and herbicides (method SW-846 8081A and 8151A)
- Dioxins and furans (method SW-846 8080A)

The list of project target parameters also includes the soil gas compounds listed in standard method TO-14/TO-15, the following geotechnical analyses: bulk density, moisture content,

particle size, and vertical hydraulic conductivity. General chemistry parameters will also be sampled and analyzed for these analytes as discussed in Sections 7.2.

The laboratory target parameters are discussed in detail in Section 7 and summarized in Tables 7-2 through 7-14.

1.5 Sampling Locations

Intended soil and groundwater sampling locations are provided on Figure 1-4. However, it is possible sampling locations may be changed, depending on the nature of encountered field conditions. The person who shall be responsible for making such decisions will be the Field Team Leader whose responsibilities are described in Section 2.

The rationale for the selected sampling locations (and depths) at each solid waste management unit and area of concern are fully described in Section 3 (Project Approach) of the Work Plan. The rationale supporting the number of samples to be collected for each matrix are also provided in Section 3 of the Work Plan.

1.6 Project Schedule

The current schedule for completion of the Final Field Investigation Report is targeted for the end of March 2000 (Figure 1-5). Changes to the scope and schedule will be addressed following the process outlined for change management in the PMP.

2. Project Organization and Responsibility

The Hoover Company is initiating a Voluntary Corrective Action (VCA) program to address RCRA Corrective Action (RCRA CA) obligations at their North Canton, Ohio facility. The Hoover Company has responsibility for all phases of the investigation. CH2M HILL will perform the field investigation, prepare the report, and perform any subsequent studies. The Hoover Company will provide project management, with support by CH2M HILL. The various quality assurance, field, laboratory, and management responsibilities of key project personnel are defined below.

2.1 Project Organization Chart

The project organization chart showing the lines of authority specific to this investigation is presented in Figure 2-1. This chart includes all individuals discussed below.

2.2 Management Responsibilities

2.2.1 USEPA RCRA Project Manager—Gerald Phillips

The responsibilities of the USEPA RCRA Project Manager are as stated in the Voluntary Corrective Action Agreement. The USEPA RCRA Project Manager has the responsibility of providing Hoover with timely review, comment, and, as appropriate, approval of Hoover's submissions pertaining to tasks being completed as part of the Voluntary Agreement. Additionally, the USEPA Project Manager will issue at the appropriate time a Statement of Basis that selects its preferred corrective measures for the Facility. Finally, after satisfactory completion of any corrective action and associated reporting, the USEPA Project Manager will coordinate the termination of this agreement and the issuance of a No Further Action Letter.

2.2.2 The Hoover Company Project Manager—Monica Satrape

The Hoover Company Project Manager, has the overall responsibility for all phases of the investigation. The Project Manager is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives and requirements. The Hoover Company Project Manager will ensure that technical, financial, and scheduling objectives are achieved successfully. The Hoover Company Project Manager will be the communication point of contact to the USEPA Region V RCRA Project Manager (RPM). The Hoover Company Project Manager will:

- Define project objectives and develop a detailed work plan schedule
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task
- Acquire and apply technical and corporate resources as needed to ensure performance within budget and schedule constraints

- Orient all field leaders and support staff concerning the project's special considerations
- Develop ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness
- Review and analyze overall task performance with respect to planned requirements and authorizations
- Approve all reports (deliverables) before their submission to USEPA Region V
- Represent the project team at meetings and public hearings

2.2.3 CH2M HILL Investigation Project Manager—Roger Huddleston

The CH2M HILL Investigation Project Manager is responsible for ensuring that the project meets USEPA's objectives and CH2M HILL quality standards. The CH2M HILL Investigation Project Manager will be responsible for the quality and distribution of interim and final reports. The CH2M HILL Investigation Project Manager will report directly to The Hoover Company Project Manager and is responsible for technical QC and project oversight.

2.3 Quality Assurance Responsibilities

2.3.1 CH2M HILL Program and QA Manager—Kathy Arnett

The CH2M HILL Program and QA Manager reports directly to The Hoover Company Project Manager and will be responsible for ensuring that all CH2M HILL procedures for this project are being followed. The CH2M HILL QA Manager will be responsible for ensuring the appropriate policies and SOPs are in place and that data review is completed on the analytical laboratory sample results.

2.3.2 CH2M HILL Project Chemist—Adrian Hanley

CH2M HILL's Project Chemist is responsible for providing chemistry support to the project and managing the analytical samples generated by this investigation. The project chemist reports directly to the CH2M HILL Investigation Project Manager. The project chemist is responsible for the preparation of this QAPP and its content, resolving analytical questions with the laboratories, tracking the samples from sample collection through data receipt, tracking the data from data receipt through data review and assisting with data use evaluation and interruption.

2.4 Laboratory Responsibilities

The laboratory tasked with responsibility for analytical work is the North Canton Facility of Quanterra Incorporated.

2.4.1 Quanterra Project and Project Operations Manager—Rebecca Strait

The Quanterra Project Manager will report directly to the CH2M HILL project chemist and will:

- Provide day-to-day coordination with the Field Team Leader on technical issues in specific areas of expertise
- Ensure all resources of the laboratory are available on an as-required basis
- Oversee production and final review of analytical reports
- Coordinate laboratory analyses
- Supervise in-house chain-of-custody
- Schedule sample analyses
- Oversee data review
- Identify problems at the laboratory level and discuss and document resolutions with the Field Team Leader
- Oversee preparation of analytical reports
- Approve final analytical reports prior to submission to The Hoover Company and CH2M HILL
- Sign the title page of the QAPP

2.4.2 Quanterra Quality Assurance Officer—Opal Davis-Johnson

The Quanterra QA Officer has the overall responsibility for data after it leaves the laboratory. The Quanterra QA Officer will be independent of the laboratory but will communicate data issues through the Quanterra Project Manager. In addition, the Quanterra QA Officer will:

- Implement QC for analytical data
- Oversee laboratory QA
- Oversee QA/QC documentation
- Conduct detailed data review
- Determine whether to implement laboratory corrective actions, if required
- Define appropriate laboratory QA procedures
- Prepare laboratory SOPs

Final responsibility for project quality rests with the CH2M HILL Investigation Project Manager. Independent QA will be provided by the Quanterra Project Manager and QA Officer prior to release of all data to The Hoover Company and CH2M HILL.

2.4.3 Quanterra Sample Custodian

The Quanterra sample receipt group will be the principal sample custodians. This group reports to the Quanterra operations manager. The Quanterra sample receipt group will:

- Receive and inspect the incoming sample containers
- Record the condition of the incoming sample containers
- Sign appropriate documents
- Verify chain-of-custody
- Notify laboratory manager and supervisor of sample receipt and inspection
- Assign a unique identification number and customer number, and enter each into the sample receiving log
- With the help of the laboratory manager, initiate transfer of the samples to appropriate lab sections
- Control and monitor access/storage of samples and extracts

2.4.4 Quanterra Technical Staff

The Quanterra technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to the Quanterra project operations manager.

2.5 Field Responsibilities

2.5.1 CH2M HILL Field Team Leader—Erik Spande

The Hoover Company Project Manager will be supported by the CH2M HILL field team leader. The Field Team Leader is responsible for leading and coordinating the day-to-day activities of the various resource specialists under his supervision. The CH2M HILL Field Team Leader is a highly experienced environmental professional and will report directly to The Hoover Company and CH2M HILL's Project Manager. The Field Team Leader will:

- Coordinate each day with the project managers on technical issues in specific areas of expertise
- Develop and implement of field-related work plans, assurance of schedule compliance, and adherence to management-developed study requirements
- Coordinate and manage field staff, including sampling and drilling, and supervising field laboratory staff
- Implement QC for technical data provided by the field staff including field measurement data
- Adhere to work schedules provided by the project manager
- Write and approve text and graphics required for field team efforts
- Coordinate and oversee technical efforts of subcontractors assisting the field team

- Identify problems at the field team level, resolving difficulties in consultation with The Hoover Company and CH2M HILL Investigation Project Managers, implement and document corrective action procedures, and provision of communication between team and upper management
- Participate in preparation of the final report

2.5.2 CH2M HILL Field Technical Staff

The technical staff for this project will be drawn from CH2M HILL's pool of corporate resources. The technical staff will be used to gather and analyze data, and to prepare various task reports and support materials. All of the designated technical team members are experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

2.6 Special Training Requirements and Certifications

Training will be provided and scheduled as required to assure that individuals have acquired the necessary skills to successfully complete their assigned task.

Certification of health and safety training is provided in the project specific Health and Safety Plan.

3. Quality Assurance Objectives

The overall QA objective for this project is to develop and implement procedures for field sampling, laboratory analysis, chain-of-custody, and reporting that will provide results that are technically valid and legally defensible in a court of law. This section will provide in greater detail specific project objectives and intended data usages mentioned in Section 1 of this QAPP. Specific procedures for sampling, chain-of-custody, laboratory instrument calibration, laboratory analysis, reporting of data, internal QC, audits, preventive maintenance of field equipment, and corrective action are described in other sections of this QAPP.

3.1 Precision

3.1.1 Definition

Precision is a measure of the degree to which two or more measurements are in agreement.

3.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicate samples at a rate of 1 duplicate per 10 field samples, per matrix. The total estimated number of duplicates for this project is found in Table 3-1.

3.1.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) and relative standard deviations (RSD) for three or more replicate samples. The equations to be used for precision in this project can be found in Section 12 of this QAPP. Precision control limits are provided in the applicable Quanterra SOPs provided in Quanterra's QAP (Attachment A).

For inorganic analyses, laboratory precision shall be assessed through the analysis of a sample/sample duplicate pair and field duplicate pairs. For organic analyses, laboratory precision shall be assessed through the analysis of matrix spike/matrix spike duplicate (MS/MSD) and field duplicate samples.

3.2 Accuracy

3.2.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference or true value.

TABLE 3-1
Sampling Parameters and Number of Samples

Sample Matrix	Analytical Parameters	Field Samples	EB	Dup	TB	MS/D	Total Samples*
Soil	**Appendix IX** VOCs – SW-846 8260B SVOCs – SW-846 8270C and 8141A Metals – SW-846 6010B, 6010B Trace, 9012A, and 7470A PCBs – SW-846 8082 Pesticides – SW-846 8081A Herbicides - SW-846 8151A Dioxins and Furans – SW-846 8280A	67	7	7	(13)	3/3	87
Soil	**Target Analyte List** VOCs – SW-846 8260B SVOCs – SW-846 8270C Metals – SW-846 6010B, 6010B Trace, 9012A, and 7470A	204	20	20	(41)	10/10	264
Soil	**Total Organic Carbon - Walkley-Black method**	20	2	2	0	1	26
Groundwater By direct push and monitoring wells	**Appendix IX** VOCs – SW-846 8260B SVOCs – SW-846 8270C and 8141A PAHs – SW-846 8270SIM Metals – SW-846 6010B, 6010B Trace, 9012A, and 7470A Dissolved Metals – SW-846 6010B, 6010B Trace, and 7470A Pesticides – SW-846 8081A Herbicides - SW-846 8151A Dioxins and Furans – SW-846 8280A	56	6	6	(10)	3/3	74
Groundwater By direct push and monitoring wells	**Target Analyte List** VOCs – SW-846 8260B SVOCs – SW-846 8270C PAHs – SW-846 8270SIM Metals – SW-846 6010B, 6010B Trace, 9012A, and 7470A Dissolved Metals – SW-846 6010B, 6010B	128	13	13	(26)	6/6	166

TABLE 3-1
Sampling Parameters and Number of Samples

Sample Matrix	Analytical Parameters	Field Samples	EB	Dup	TB	MS/D	Total Samples*
	Trace, and 7470A						
Soil	**Geotechnical Analyses**	17	2	2	0	1	23
	Bulk Density – ASTM D2937						
	Moisture Content – ASTM D2216						
	Particle Size – ASTM D422						
	Vertical Hydraulic Conductivity – ASTM D5084 or D2434						
Groundwater	**Natural Attenuation**	16	2	2	0	1/1	22
By direct push and monitoring wells	Total Iron and Manganese – will be analyzed with the total metals sample for the Appendix IX or TAL sample at that site. SW-846 6010B						
	Dissolved Iron and Manganese – SW-846 6010B						
	Dissolved Ferric and Ferrous Iron – 3500 FED						
	Chloride, Sulfate, Nitrate – USEPA – 300.0						
	Carbon Dioxide and Methane – RSK 175						
	Total Phosphorous – USEPA 365.2						
Groundwater	**Treatability**	32	4	4	0	2/2	44
By direct push and monitoring wells	Total Iron – will be analyzed with the total metals sample for the Appendix IX or TAL sample at that site. SW-846 6010B						
	Dissolved Iron – SW-846 6010B						
	Biological Oxygen Demand – USEPA 405.1						
	Chemical Oxygen Demand – USEPA 410.4						
	Hardness – USEPA 130.2						
	Ammonia – USEPA 350.3						
	Total Kjeldahl Nitrogen – USEPA 351.3						
	Nitrate, Nitrite, Sulfate – USEPA 300.0						
	Sulfite – USEPA 377.1						
	Total Dissolved Solids – USEPA 160.1						
	Total Suspended Solids – USEPA 160.2						
	Total Organic Carbon - Walkley-Black method						

TABLE 3-1
Sampling Parameters and Number of Samples

Sample Matrix	Analytical Parameters	Field Samples	EB	Dup	TB	MS/D	Total Samples*

NOTE: This sample count includes contingency samples. If the contingency samples are not collected, then the scope will be about 15-20% less in scope.
*The total number of samples does not include trip blanks, because trip blanks are only analyzed for VOCs.

3.2.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of field and trip blanks and through the adherence to all sample handling, preservation, and holding times.

3.2.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of MS/MSD, standard reference materials (SRM), laboratory control samples (LCS) and surrogate compounds, and the determination of percent recoveries. The equation to be used for accuracy in this project can be found in Section 12 of this QAPP. Accuracy control limits are provided in the Quanterra QAP.

3.3 Completeness

3.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is presented in Section 12 of this QAPP. The field completeness objective for this project will be greater than 90 percent.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is presented in Section 12 of this QAPP. The laboratory completeness objective for this project will be greater than 95 percent.

3.4 Representativeness

3.4.1 Definition

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition within a defined spatial and/or temporal boundary.

3.4.2 Measures to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the RFI Work Plan is followed and that proper sampling techniques are used. In designing the sampling program, media of concern have been specified.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory is ensured by using the proper analytical procedures, appropriate methods, meeting sample holding times and analyzing and assessing field duplicate samples. The sampling network was designed to provide data representative of facility conditions. During development of this network, consideration was given to past waste disposal practices, existing analytical data, physical setting and processes, and constraints inherent to the RCRA program. The rationale of the sampling network is discussed in detail in Section 3 of the Work Plan.

3.5 Decision Rules

3.5.1 Definition

A Decision Rule is a statement that allows for a course of action or non-action to be taken, based on assumptions made to draw out and test its logical or empirical consequences.

3.5.2 Project Decision Rules

The decision rules for this RFI are as follows:

- If no detectable concentrations of contaminants are detected, or if no contaminant concentrations are found in any discrete soil or groundwater sample exceeding a project specific remedial level (screening levels, human health or ecological risk levels, federal or state levels) at any one location, no further sampling is intended or will be performed in the vicinity of this location.
- If soil or groundwater sample concentrations along the perimeter exceed target screening levels, a further evaluation or investigation will be conducted in this area to determine if there are potential risks to human health, groundwater, or the environment.
- If soil or groundwater sample concentrations in an offsite area exceed target screening levels, a further evaluation or investigation will be conducted in this area to determine if there are potential risks to human health, groundwater, or the environment.
- If groundwater sample concentrations along the perimeter exceed target screening levels, a further evaluation or investigation will be conducted to assess whether implementation of interim corrective actions at the facility perimeter may be beneficial, and if so, identify potential alternatives and begin planning for implementation of those actions.

- If groundwater sample concentrations along the perimeter exceed MCLs, further evaluation will be conducted to assess whether there is a need to implement groundwater monitoring from the established monitoring well network.

3.6 Comparability

3.6.1 Definition

Comparability is an expression of the confidence with which one data set can be compared to another.

3.6.2 Measures to Ensure Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the Sampling and Analysis Plan is followed and that proper sampling techniques are used.

3.6.3 Measures to Ensure Comparability of Laboratory Data

Planned analytical data will be comparable when similar sampling and analytical methods are used and documented in the QAPP. Comparability is also dependent on similar QA objectives.

3.7 Level of Quality Control Effort

Quanterra has a QC program to assess the reliability and validity of the analyses being performed. The purpose and creation of QC samples is discussed in the SAP and summarized below. QC procedures for field parameter measurements include calibrating or verifying the calibration of the field instruments daily (more frequently if required), measuring duplicate samples at a frequency of 10 percent, and checking the reproducibility of the measurements by taking multiple readings from a single sample at a frequency of 10 percent.

Trip blanks are used to detect VOC contamination during sample shipping and handling. Quanterra Inc. will provide trip blank samples. Trip blanks will consist of a certified clean sample vial filled with contaminant-free laboratory water. The vials must contain no air bubbles. One or more trip blank samples will be sent each day that VOC samples are supplied to the laboratory. Each trip blank will be associated to all of the samples taken by one field team for that entire day. One trip blank will be included in each cooler containing VOC samples.

Equipment rinsate blanks (EB) are samples of ASTM Type II water passed through and over the surface of decontaminated sampling equipment. The water is collected in sample bottles, preserved, and handled just as the field samples. Although the equipment type may change from site to site, the concept is the same. The water needs to be run over the parts sampling equipment that make contact with the sample, be they bailers, surface water sampling pitchers, sampling spoons, bowls, hand augers, drill rig equipment that touches the soil, etc. If disposable equipment is used, a never-used piece of this equipment is used

for the EB. This usually includes disposable bailers, Shelby tubes, or acetate split-spoon liners.

EBs are used to monitor the effectiveness of the decontamination process and cleanliness of the sampling equipment. The frequency for EBs is 1 per 10 field samples per type of sampling equipment, or 10 percent. If more than one type of sampling equipment is used to collect samples for a particular matrix, at least one EB is collected and submitted for each type of equipment. EBs typically are analyzed for the same analytes as the corresponding samples.

Duplicate or "blind" field samples (field duplicate samples) are collected to monitor the precision of the field sampling and analytical process. The identity of the duplicate samples is not noted on the laboratory COC form. The frequency for the collection and analysis of field duplicates is 1 per 10 field samples per matrix. The identity of the duplicate samples will be recorded in the field-sampling logbook

Matrix spike (MS) and matrix spike duplicate (MSD) samples are collected to measure the precision and accuracy of the field sampling and laboratory analysis. One MS and one MSD sample pair will be collected for every 20 field samples per matrix.

Note: Quality control samples are generally not taken for geotechnical samples.

4. Sampling Procedures

The sampling procedures to be used in this site investigation will be consistent for the objectives of this project. The SAP provides the SOPs for all sampling activities to be conducted during this investigation. The SOPs are presented in Appendix C of the SAP.

5. Custody Procedures

Sample custody procedures include the use of field logbooks, sample labels, custody seals, and COC forms. Each person involved with sample handling must be trained in COC procedures before the start of field operations. The COC form must accompany the samples during shipment from the field to the laboratory.

A sample is under custody under the following conditions:

- It is in one's actual possession
- It is in one's view, after being in one's physical possession
- It was in one's physical possession and one locks it up to prevent tampering
- It is in a designated and identified secure area

Quanterra shall comply with its laboratory sample custody requirements outlined in its quality assurance plan (QAP). The field team leader or designee will notify Rebecca Strait, the Quanterra Project Manager, of daily field sampling activities and the subsequent transfer of samples to the laboratory.

5.1 Field Custody Procedures

Proper sample handling, transfer, and custody are key components of building the documentation and support for data that could be used to make project decisions. It is important that all sample handling and sample custody requirements be performed completely, accurately, and consistently. Field custody procedures are summarized below and provided as a SOP in Appendix C in the SAP.

A properly completed chain-of-custody (COC) form will accompany all samples submitted to the laboratory. The unique sample ID numbers and descriptive identification information (soil boring or well location, date, time, etc.) will be listed on the COC form. When transferring possession of samples, the individuals relinquishing and receiving them will sign, date, and note the time on the record. The COC record documents transfer of sample custody from the sampler to the laboratory.

Samples will be properly packaged for transfer and dispatched to Quanterra for analysis with a separate signed custody record enclosed in each sample box or cooler. Hard plastic ice chests or coolers with similar durability will be used to transport samples. Samples must be sealed in individual plastic bags and cushioned within the sample box or cooler to prevent damage. Shipping containers will be closed and secured with strapping tape and custody seals for transfer to the laboratory. The preferred procedure includes use of custody seals attached to two sides of the cooler. The custody seals are to be covered with clear plastic tape. The cooler is to be strapped shut with strapping tape in at least two locations.

The COC record identifying the cooler or shipping box contents will accompany all shipments. The original record will accompany the samples, and the field copies will be retained by the sampler to accommodate sample tracking.

5.2 Laboratory Custody Procedures

Quanterra, of North Canton must comply with the laboratory sample custody requirements as outlined in the subcontract documents and their own QAP. The Field Team Leader (FTL) or designee will notify the laboratory of daily field sampling activities and the subsequent transfer of samples to the laboratory.

5.3 Final Evidence Files

The final evidence file will be the central repository for all documents that constitute evidence relevant to sampling and analysis activities. CH2M HILL will be the custodian of the evidence file and maintains the contents of the evidence files for the RFI, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews in a secured, limited access area under the custody of CH2M HILL.

CH2M HILL will keep all records until project completion and project closeout. As necessary, records may be transferred to an offsite records storage facility. The records storage facility must provide secure, access controlled storage of records. Records of raw analytical laboratory data, quality assurance data, and reports will be kept by the subcontract laboratory for at least 6 years.

The final evidence file will include at a minimum:

- Field logbooks
- Field data and data deliverables
- Photographs
- Drawings
- Soil boring logs
- Laboratory data deliverables
- Data review reports
- Data assessment reports
- Progress reports, QA reports, interim project reports, etc.
- All custody documentation (tags, forms, air bills, etc.)

6. Calibration Procedures and Frequency

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

6.1 Field Instrument Calibration

Because instruments used for field activities may be of several models and manufacturers, it is not feasible to present instrument-specific details in this section. Instrument-specific calibration must be performed in accordance with the manufacturer's instruction.

Field instruments will be calibrated daily in accordance with manufacturers' specifications before the beginning of sampling activities. Calibration will be verified daily for field instruments calibrated by the manufacturer. Standards used to calibrate the field survey instruments will be traceable to the standards of the National Institute of Standards and Technology whenever possible. If a field instrument cannot be adjusted to be within calibration, the instrument must not be used and must be replaced with a functioning instrument.

6.2 Laboratory Instrument Calibration

Laboratory instruments will be calibrated in accordance with manufacturers' directions and applicable method specifications. Laboratory instrument calibration procedures are documented in the appropriate logbook or logsheet which may be electronic or hardcopy. Instrument calibration is reviewed by the analyst and a senior chemist prior to sample data release.

7. Analytical Procedures

The Quanterra facility at 4101 Shuffel Drive N.W., North Canton, Ohio, 44720, will analyze the groundwater, surface water, soil, and sediment samples. The phone number there is 330-497-9396. Quanterra's Earth City facility at 13715 Rider Trail North, Earth City, MO 63045, will assist the North Canton Laboratory as necessary. The phone number there is 314-298-8566.

The low level PAH analyses will be completed at Quanterra's Arvada Colorado facility, at 4955 Yarrow Street Arvada, CO 80002. The phone number is 303-421-6611.

The herbicide analyses will be completed at Quanterra's facility at Building 4, Fourth Floor Pittsburgh, PA 15238. The phone number is 412-820-8380.

The dissolved gas analyses will be completed at Quanterra's facility at 1721 South Grand Avenue Santa Ana, CA 92705. The phone number is 714-258-8610.

The dioxin and furan samples will be analyzed by Quanterra's facility at 880 Riverside Parkway West Sacramento, CA 95605. The phone number is 916-373-5600.

The geotechnical soil samples will be analyzed by Applied Construction Technologies of 210 Hayes Drive, Suite C, Cleveland, OH 44131. Their phone number is 216-459-8378.

7.1 Field Analytical Procedures

The procedures for the field determination of pH, conductivity, temperature, DO, and reductional potential are provided in the SOPs included as Appendix C to the SAP.

7.2 Laboratory Analytical Procedures

The laboratories named above will implement the project required SOPs as defined by their QAP. The laboratory SOPs for sample preparation, cleanup, and analysis are based on SW-846 methodologies and other USEPA methods as cited in the tables below. The analytical procedures provide sufficient detail to successfully complete this investigation.

The documentation of appropriate method review for the project target compounds is submitted in Section 9.2 of this QAPP.

The sample container, preservation and holding time requirements are provided in Table 7-1. The analyte groups of interest, appropriate analytical method reference, and required reporting limit for this investigation are discussed below and summarized in Tables 7-2 through 7-14. The soil reporting limits as listed in the tables below are provided as wet weights. The laboratory will report the soil concentrations as dry weights. Wet weight results can be calculated from dry weight results by multiplying the analyte (dry weight) concentration by the solid content of the sample. For example, a sample that is 74 percent solids and has an analyte dry weight concentration of 10 mg/kg, would have an analyte (wet weight) concentration of 7.4 mg/kg [10 mg/kg × 0.74 = 7.4 mg/kg].

TABLE 7-1
Sample Containers, Preservatives, and Holding Times

Analysis	Method	Container	Preservation and Storage	Maximum Hold Time
Soil				
VOCs	SW-846 method 5035 and 8260B	Three 5-gram Encore™ sampling receptacles *	4°C	Frozen or analyzed within 48 hr, if frozen samples shall be analyzed within 14 days from time of collection
SVOCs and OPPs	SW-846 method 8270C and 8141A	Two 16-oz containers, Teflon cap	4°C	14 days to extraction, 40 days from extraction to analysis
Metals	SW-846 method 6010B, 6010B trace, and 7470A		4°C	180 days, 28 days for mercury
Cyanide	SW-846 Method 9012A		4°C	14 days
PCBs and Pesticides	SW-846 method 8082 and 8081A		4°C	14 days to extraction, 40 days from extraction to analysis
Herbicides	SW-846 method 8151A		4°C	14 days to extraction, 40 days from extraction to analysis
TOC	Walkley-Black Method		4°C	28 days
Geotechnical Analyses	ASTM Methods (See Table 11)	1 - 2" diameter 30" long Shelby tube.	4°C	—
Soil Gas				
VOCs	TO-14	Vacuum Canister	4°C	30 days
Groundwater				
VOCs	SW-846 method 8260B	Three 40-mL vials	HCl to pH ≤ 2, 4°C	14 days
SVOCs	SW-846 method 8270C	Two 1-liter amber glass jars, Teflon cap	4°C	7 days to extraction, 40 days from extraction to analysis
SVOCs: Low-Level PAHs	SW-846 method 8270SIM	Two 1-liter amber glass jars, Teflon cap	4°C	7 days to extraction, 40 days from extraction to analysis
OPPs	SW-846 method 8141A	Two 1-liter amber glass jar, Teflon cap	4°C	7 days to extraction, 40 days from extraction to analysis
Metals	SW-846 method 6010B, 6010B trace, and 7470A	1-liter polyethylene bottle	HNO_3 to pH ≤ 2, 4°C	180 days, Hg = 28 days
Dissolved Iron and Manganese	SW-846 method 6010B	250 mL polyethylene bottle	4°C	180 days
PCBs and Pesticides	SW-846 method 8082 and 8081A	Three 1-liter amber glass jar, Teflon cap	4°C	7 days to extraction, 40 days from extraction to analysis
Herbicides	SW-846 method 8151A	Two 1-liter amber glass jar, Teflon cap	4°C	7 days to extraction, 40 days from extraction to analysis
Cyanide	SW-846 Method 9012A	1-liter polyethylene bottle	NaOH to pH > 12, 4°C	14 days
Ammonia	USEPA 350.3	500mL polyethylene bottle	H_2SO_4 to pH	28 days

TABLE 7-1
Sample Containers, Preservatives, and Holding Times

Analysis	Method	Container	Preservation and Storage	Maximum Hold Time
			≤ 2 and cool to 4°C	
Carbon Dioxide Methane	RSK 175	4 – 40mL vials	HCl to pH ≤ 2, 4°C	14 days
Hardness	USEPA 130.2	250 mL polyethylene bottle	HNO_3 to pH ≤ 2 and cool to 4°C	180 days
Phosphorous, total	USEPA 365.2	1-liter polyethylene bottle	H_2SO_4 to pH ≤ 2 and cool to 4°C	28 days
TKN	USEPA 351.3			
Chloride, Nitrate, Nitrite, and Sulfate	USEPA 300.0	500 mL polyethylene bottle	4°C	48 hours
Sulfite	USEPA 377.1	500 mL polyethylene bottle	4°C	24 hours
Total Dissolved Solids	USEPA 160.1			7 days
Total Suspended Solids	USEPA 160.2			7days
BOD	USEPA 405.1	2-liter polyethylene bottle	4°C	48 hours to set up
COD	USEPA 410.4	250 mL polyethylene bottle	H_2SO_4 to pH ≤ 2 and cool to 4°C	28 days
Dissolved Ferric and Ferrous Iron	3500FE D	250 mL polyethylene bottle	4°C	24 hours
pH	Field Measurement	—	—	—
Conductivity	Field Measurement	—	—	—
Temperature	Field Measurement	—	—	—
Reduction Potential	Field Measurement	—	—	—
Dissolved Oxygen	Field Measurement	—	—	—

— = Not applicable
* 7 Encore™ Sampling Receptacles will be submitted for soil samples with associated MS/MSD analyses.
** Minimum of an additional double volume of water will be submitted for groundwater samples with associated MS/MSD analyses.

Samples will be analyzed using USEPA-approved methods or other recognized standard methods. The principal sources for analytical methods, in order of preference, are:

- SW-846, Test Methods for Evaluating Solid Wastes
- USEPA Methods for Chemical analyses for Water/Wastewater
- ASTM for analysis of Geotechnical Samples

The scope of the method and a summary of the analytical QA/QC are provided in this document. The method QA/QC is provided in detail in the laboratory QAP.

The analytical suites covered in this QAPP are:

- Volatile organic compounds (method SW-846 8260B)
- Semivolatile organic compounds (method SW-846 8270C and 8141)
- Low-level PAHs (method SW-846SIM)
- Metals (SW-846 6010B, 9012A, and 7000 series methods)
- Polychlorinated biphenyls (method SW-846 8082)
- Pesticides and herbicides (method SW-846 8081A and 8151A)
- Dioxins and furans (method SW-846 8080A)
- Geotechnical analyses
- General chemistry analyses

7.2.1 VOC Analysis

The VOCs will be analyzed in accordance with the analytical protocol from method SW-846 8260B *Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS)*. Method 8260B is to be used for soil and groundwater sample analyses. Reporting limits for the Appendix IX VOCs are shown in Table 7-2, the focused VOC TAL is provided as Table 7-3. Quanterra's North Canton laboratory will report sample results down to the reporting limits (RL) specified on each table. QC requirements for method 8260B are described in a standard operating procedure contained in the laboratory QAP.

7.2.2 SVOC Analysis

The SVOCs will be analyzed in accordance with the analytical protocol taken from method SW-846 8270C, *Analytical Methods for Semi-volatiles*, and SW-846 8141A, *Organophosphorous Compounds by Gas Chromatography: Capillary Column Technique.* Method 8141A will only be used for parathion, methyl parathion; disulfoton; phorate; famphur; O,O,O-Triethyl phosphorothioate; O,O-Diethyl O-2-pyrazinyl phosphorothioate; and Tetraethyl dithiopyrophosphate. These eight compounds either cannot be analyzed by 8270, or the Appendix IX table recommends the use of method 8141A. Quanterra will use method SW-846 8270C to analyze for SVOCs in soil and groundwater. Reporting limits for the Appendix IX SVOCs are listed in Table 7-4, the focused SVOC TAL is provided as Table 7-5.

TABLE 7-2
Reporting Limits for the Appendix IX VOCs by SW-846 Method 8260B

	Compound	Water RL (µg/L)	Soil RL (µg/kg)		Compound	Water RL (µg/L)	Soil RL (µg/kg)
1	Ethyl methacrylate	1	5	30	cis-1,2 Dichloroethylene	0.5	5
2	1,1,1,2-Tetrachloroethane	1	5	31	cis-1,3-Dichloropropene	1	5
3	1,1,1-Trichloroethane	1	5	32	Dibromochloromethane	1	5
4	1,1,2,2-Tetrachloroethane	1	5	33	Dichlorodifluoromethane	2	10
5	1,1,2-Trichloroethane	1	5	34	Ethylbenzene	1	5
6	1,1-Dichloroethane	1	5	35	Iodomethane	1	5
7	1,1-Dichloroethylene	1	5	36	Isobutyl alcohol	50	200
8	1,2,3-Trichloropropane	1	5	37	Methacrylonitrile	1	5
9	1,2-Dibromo-3-chloropropane	2	10	38	Methyl bromide	2	10
10	1,2-Dibromoethane	1	5	39	Methyl chloride	2	10
11	1,2-Dichloroethane	1	5	40	Methyl ethyl ketone	10	20
12	1,2-Dichloropropane	1	5	41	Methyl iodide	1	5
13	1,4-Dioxane	200	500	42	Methyl methacrylate	1	5
14	2-Hexanone	10	20	43	Methylene bromide	1	5
15	4-Methyl-2-pentanone	5	20	44	Methylene chloride	1	5
16	Acetone	10	20	45	N-butyl alcohol	50	120
17	Acetonitrile	20	100	46	Propionitrile	4	20
18	Acrolein	20	100	47	Styrene	1	5
19	Acrylonitrile	20	100	48	Tetrachloroethylene	1	5
20	Allyl chloride	2	10	49	Toluene	1	5
21	Benzene	1	5	50	trans-1,2-Dichloroethylene	0.5	2.5
22	Bromodichloromethane	1	5	51	trans-1,3-Dichloropropene	1	5
23	Bromoform	1	5	52	trans-1,4-Dichloro-2-butene	1	5
24	Carbon disulfide	1	5	53	Trichloroethylene	1	5
25	Carbon tetrachloride	1	5	54	Trichlorofluoromethane	2	10
26	Chlorobenzene	1	5	55	Vinyl acetate	2	10
27	Chloroethane	2	10	56	Vinyl chloride	2	10
28	Chloroform	1	5	57	Xylene (total)	1	5
29	Chloroprene	1	5				

Soil results must be reported on a dry weight basis.

RL may not be obtained due to high analyte or water content.

TABLE 7-3
Reporting Limits for the Focused VOC List (SW-846 Method 8260B)

	Compound	Water RL (µg/L)	Soil RL (µg/kg)
1	1,1,1-Trichloroethane	1	5
2	1,1,2-Trichloroethane	1	5
3	1,1-Dichloroethane	1	5
4	1,1-Dichloroethylene	1	5
5	1,2-Dichloroethane	1	5
6	4-Methyl-2-pentanone	5	20
7	Benzene	1	5
8	n-Butyl alcohol	50	120
9	Carbon disulfide	1	5
10	Carbon tetrachloride	1	5
11	Chlorobenzene	1	5
12	Chloroform	200	500
13	cis-1,2-Dichloroethylene	0.5	5
14	Dichlorodifluoromethane	2	10
15	Ethylbenzene	1	5
16	Isobutyl alcohol	50	200
17	Methyl ethyl ketone	10	20
18	Methylene chloride	1	5
19	Tetrachloroethylene	1	5
20	Toluene	1	5
21	trans-1,2-Dichloroethylene	0.5	2.5
22	Trichloroethylene	1	5
23	Trichlorofluoromethane	2	10
24	Vinyl chloride	1	5
25	Xylenes	1	5

TABLE 7-4
SVOCs: Reporting Limits for the Appendix IX SVOCs by SW-846 Method 8270C

	Compound	Water RL (µg/L)	Soil RL (µg/kg)		Compound	Water RL (µg/L)	Soil RL (µg/kg)
1	1,2-Dichlorobenzene	10	330	33	Acenaphthene	10	330
2	1,3-Dichlorobenzene	10	330	34	Acenaphthylene	10	330
3	1,4-Dichlorobenzene	10	330	35	Acetophenone	10	330
4	3,3'-Dichlorobenzidine	50	1600	36	α,α-Dimethylphenethylamine	50	1600
5	1,2,4,5-Tetrachlorobenzene	10	330	37	Aniline	10	330
6	1,2,4-Trichlorobenzene	10	330	38	Anthracene	10	330
7	1,4-Naphthoquinone	50	1600	39	Aramite	20	660
8	1-Naphthylamine	10	330	40	Benzo(a)anthracene	10	330
9	2,3,4,6-Tetrachlorphenol	50	1600	41	Benzo(a)pyrene	10	330
10	2,4,5-Trichlorophenol	10	330	42	Benzo(b)fluoranthene	10	330
11	2,4,6-Trichlorophenol	10	330	43	Benzo(g,h,i)perylene	10	330
12	2,4-Dichlorophenol	10	330	44	Benzo(k)fluoranthene	10	330
13	2,4-Dimethylphenol	10	330	45	Benzyl alcohol	10	330
14	2,4-Dinitrophenol	50	1600	46	Bis(2-chloro-1-methyl)ether	10	330
15	2,4-Dinitrotoluene	10	330	47	Bis(2-chloroethoxy)methane	10	330
16	2,6-Dichlorophenol	10	330	48	Bis(2-chloroethyl)ether	10	330
17	2,6-Dinitroluene	10	330	49	Bis(2-ethylhexyl)phthalate	10	330
18	2-Acetylaminofluorene	100	3300	50	Butyl benzyl phthalate	10	330
19	2-Chloronaphthalene	10	330	51	Chlorobenzilate	10	330
20	2-Chlorophenol	10	330	52	Chrysene	10	330
21	2-Methylnaphthalene	10	330	53	Diallate	20	660
22	2-Naphthylamine	10	330	54	Dibenz(a,h)anthracene	10	330
23	2-Picoline	20	660	55	Dibenzofuran	10	330
24	3,3'-Dimethylbenzidine	50	1600	56	Diethyl phthalate	10	330
25	3-Methylcholanthrene	20	660	57	Dimethoate	20	660
26	4,6-Dinitro-o-cresol	50	1600	58	Dimethyl phthalate	10	330
27	4-Aminobiphenyl	50	1600	59	Di-n-butyl phthalate	10	330
28	4-Bromophenyl phenyl ether	10	330	60	Di-n-octyl phthalate	10	330
29	4-Chlorophenyl phenyl ether	10	330	61	Dinoseb	20	660
30	4-Nitroquinoline 1-oxide	100	3300	62	Diphenylamine	10	330
31	5-Nitro-o-toluidine	20	660	63	Disulfoton*	1	33
32	7,12-Dimethylbenz(a)anthracene	20	660	64	Ethyl methanesulfonate	10	330

TABLE 7-4
SVOCs: Reporting Limits for the Appendix IX SVOCs by SW-846 Method 8270C

	Compound	Water RL (µg/L)	Soil RL (µg/kg)		Compound	Water RL (µg/L)	Soil RL (µg/kg)
65	Famphur*	1	33	93	O,O,O-Triethyl phosphorothioate*	1	33
66	Fluoranthene	10	330	94	O,O-Diethyl O-2-pyrazinyl phosphorothioate*	1	33
67	Fluorene	10	330	95	o-Cresol	10	330
68	Hexachlorobenzene	10	330	96	o-Nitroaniline	50	1600
69	Hexachlorobutadiene	10	330	97	o-Nitrophenol	10	330
70	Hexachlorocyclopentadiene	50	1600	98	o-Toluidine	20	660
71	Hexachloroethane	10	330	99	p-(Dimethylamino)azobenzene	20	660
72	Hexachloropropene	100	3300	100	Parathion*	1	33
73	Indeno(1,2,3-cd)pyrene	10	330	101	p-Chloroaniline	10	330
74	Isophorone	10	330	102	p-Chloro-m-cresol	10	330
75	Isosafrole	20	660	103	p-Cresol	10	330
76	m-Cresol	10	330	104	Pentachlorobenzene	10	330
77	m-Dinitrobenzene	10	330	105	Pentachloroethane	50	1600
78	Methapyrilene	50	1600	106	Pentachloronitrobenzene	50	1600
79	Methyl methanesulfate	10	330	107	Pentachlorophenol	10	330
80	Methyl parathion*	1	33	108	Phenacetin	20	660
81	m-Nitroaniline	50	1600	109	Phenanthrene	10	330
82	Naphthalene	10	330	110	Phenol	10	330
83	Nitrobenzene	10	330	111	Phorate*	1	33
84	N-Nitrosodiethylamine	10	330	112	p-Nitroaniline	50	1600
85	N-Nitrosodimethylamine	10	330	113	p-Nitrophenol	50	1600
86	N-Nitrosodi-n-butylamine	10	330	114	p-Phenylenediamine	100	3300
87	N-Nitrosodiphenylamine	10	330	115	Pronamide	20	660
88	N-Nitrosodipropylamine	10	330	116	Pyrene	10	330
89	N-Nitrosomethylethylamine	10	330	117	Pyridine	20	660
90	N-Nitrosomorpholine	10	330	118	Safrole	20	660
91	N-Nitrosopiperidine	10	330	119	sym-Trinitrobenzene	50	1600
92	N-Nitrosopyrrolidine	10	330	120	Tetraethyl dithiopyrophosphate*	1	33

Soil results must be reported on a dry weight basis.
These compounds will be analyzed by method SW-846 8141A

TABLE 7-5
Reporting Limits for the Focused SVOC List (SW-846 Method 8270C)

	Compound	Water RL (µg/L)	Soil RL (µg/kg)		Compound	Water RL (µg/L)	Soil RL (µg/kg)
1	Acenaphthene	10	330	13	1,2-Dichlorobenzene	10	330
2	Acenaphthylene	10	330	14	Diethyl phthalate	10	330
3	Anthracene	10	330	15	Dimethyl phthalate	10	330
4	Benzo(a)anthracene	10	330	16	Di-n-butyl phthalate	10	330
5	Benzo(a)pyrene	10	330	17	Di-n-octyl phthalate	10	330
6	Benzo(b)fluoranthene	10	330	18	Fluoranthene	10	330
7	Benzo(g,h)perylene	10	330	19	Fluorene	10	330
8	Benzo(k)fluoranthene	10	330	20	Indeno(1,2,3-cd)pyrene	10	330
9	Bis(2-ethylhexyl)phthalate	10	330	21	Naphthalene	10	330
10	Butyl benzyl phthalate	10	330	22	Phenanthrene	10	330
11	Chrysene	10	330	23	Pyrene	10	330
12	Dibenz(a,h)anthracene	10	330	24	Pyridine	20	660

7.2.3 Low-Level Polyaromatic Hydrocarbons

Selected polyaromatic hydrocarbons (PAHs) will be analyzed at Quanterra's Austin, TX, or Denver, CO, facilities in accordance with the analytical protocol taken from method SW-846 8270 SIM. Table 7-6 presents the PAH list and RLs for these select PAHs to be analyzed by SW-846 method 8270 SIM. Table 7-6 will be used for groundwater samples where PAH analyses are performed.

TABLE 7-6
SVOCs: Low-Level PAH Project-Specific Analyte List and Reporting Limits for SW-846 Method 8270 SIM, For Specific Groundwater Samples Only

	Compound	Water RL (µg/L)		Compound	Water RL (µg/L)
1	Benzo(a)anthracene	0.02	7	Dibenz(a,h)anthracene	0.02
2	Benzo(b)fluoranthene	0.02	8	7,12-Dimethylbenz(a)anthracene	0.5
3	Benzo(k)fluoranthene	0.02	9	Indeno(1,2,3-cd)pyrene	0.02
4	Benzo(ghi)perylene	0.02	10	3-Methylcholanthrene	0.5
5	Benzo(a)pyrene	0.02	11	2-Methylnaphthalene	0.02
6	Chrysene	0.02	12	Naphthalene	0.02

TABLE 7-7
Metals: Reporting Limits For the Appendix IX Metals By Sw-846 Method 6010b, 9012a, and 7000 Series Methods

	Analyte	Water RL (µg/L)	Soil RL (µg/kg)		Analyte	Water RL (µg/L)	Soil RL (µg/kg)
1	Antimony	60	6000	11	Mercury	0.2	100
2	Arsenic	10	1000	12	Nickel	40	4000
3	Barium	200	20000	13	Selenium	5	500
4	Beryllium	5	500	14	Silver	10	1000
5	Cadmium	5	500	15	Sulfide	500	50000
6	Chromium	10	1000	16	Thallium	10	1000
7	Cobalt	50	5000	17	Tin	100	10000
8	Copper	25	2500	18	Titanium	50	5000
9	Cyanide	10	500	19	Vanadium	50	5000
10	Lead	3	300	20	Zinc	20	2000

7.2.4 Metals Analysis

Site soil and groundwater samples will be analyzed in accordance with analytical protocol taken from SW-846 6010B, *Inductively Coupled Plasma-Atomic Emission Spectroscopy*, 9012A, and other 7000 series methods. Quanterra Inc. will use methods SW-846 6010B, 9012A, and other 7000 series methods to analyze for inorganic compounds and cyanide in select soil and groundwater samples. Reporting limits for the Appendix IX inorganic compounds are presented in Table 7-7, the focused metals TAL is provided as Table 7-8.

TABLE 7-8
Reporting Limits For the Focused Metals List (Method 6010b, 9012a, and 7000 Series Methods)

	Analyte	Water RL (µg/L)	Soil RL (µg/kg)
1	Barium	200	20000
2	Cadmium	5	500
3	Chromium	10	1000
4	Copper	25	2500

7.2.5 Polychlorinated Biphenyls Analysis

The polychlorinated biphenyls (PCBs) will be analyzed in accordance with the analytical protocol taken from method SW-846 8082. Table 7-9 presents Appendix IX PCB list and reporting limits as analyzed by SW-846 method 8082. Table 7-9 will be used for all groundwater and soil samples where PCB analyses are performed.

7.2.6 Pesticide and Herbicide Analyses

Pesticide and herbicide samples will be analyzed in accordance with the analytical protocol taken from method SW-846 8081A and 8151A. Table 7-9 presents the Appendix IX pesticide and herbicide list and Reporting limits for SW-846 method 8081A and 8151A. Table 7-10 provides the focused pesticide and herbicide TAL.

TABLE 7-9
Analyte List and Reporting Limits for SW-846 Method 8082

	Analyte	Water RL (µg/L)	Soil RL (µg/kg)		Analyte	Water RL (µg/L)	Soil RL (µg/kg)
1	Aroclor-1016	1	33	5	Aroclor-1248	1	33
2	Aroclor-1221	1	33	6	Aroclor-1254	1	33
3	Aroclor-1232	1	33	7	Aroclor-1260	1	33
4	Aroclor-1242	1	33				

TABLE 7-10
Pesticides and Herbicides: Appendix IX List Reporting Limits for SW-846 Method 8081A/8151A

	Analyte	Water RL (µg/L)	Soil RL (µg/kg)		Analyte	Water RL (µg/L)	Soil RL (µg/kg)
1	4,4'-DDD	0.05	1.7	13	Endosulfan sulfate	0.05	1.7
2	4,4'-DDE	0.05	1.7	14	Endrin	0.05	1.7
3	4,4'-DDT	0.05	1.7	15	Endrin aldehyde	0.05	1.7
4	Aldrin	0.05	1.7	16	Heptachlor	0.05	1.7
5	α-BHC	0.05	1.7	17	Heptachlor epoxide	0.05	1.7
6	β-BHC	0.05	1.7	18	Isodrin	0.1	3.3
7	γ-BHC	0.05	1.7	19	Kepone	1.0	33
8	δ-BHC	0.05	1.7	20	Methoxychlor	1.0	3.3
9	Chlordane	0.5	17	21	Toxaphene	2.0	67
10	Dieldrin	0.05	1.7	22	2,4,5-T	1.0	20
11	Endosulfan I	0.05	1.7	23	2,4-D	4.0	80
12	Endosulfan II	0.05	1.7	24	Silvex	1.0	20

7.2.7 Soil Gas Analyses

Soil gas analyses may be performed at a later date. The rationale and location of these sited will be contained in the project-specific work plan and SAP. The list of analytes below contains all of the analytes on the Standard TO-14/TO-15/EPA 18 MOD List. The soil gas samples will be extracted by direct injection into the gas chromatograph, following the Volatile Organics by GC/MS (TO-14 Std.) method. Table 7-11 presents the analyte list and required reporting limits.

TABLE 7-11
Soil Gases: Reporting Limits for TO-14 Standard Method

	Analyte	Water RL (µg/L)		Analyte	Water RL (µg/L)
1	Acetone	10	22	1,1-Dichloroethene	2
2	Benzene	2	23	1,2-Dichloropropane	2
3	Bromodichloromethane	2	24	cis-1,3-Dichloropropene	2
4	Bromoform	2	25	trans-1,3-Dichloropropene	2
5	Bromomethane	2	26	Ethylbenzene	2
6	2-Butanone (MEK)	10	27	Hexachlorobutadiene	4
7	Carbon disulfide	10	28	2-Hexanone	30
8	Carbon tetrachloride	2	29	Methylene chloride	2
9	Chlorobenzene	2	30	4-Methyl-2-pentanone (MIBK)	10
10	Dibromochloromethane	2	31	Styrene	2
11	Chloroethane	4	32	1,1,2,2-Tetrachloroethane	2
12	Chloroform	2	33	Tetrachloroethene	2
13	Chloromethane	4	34	Toluene	2
14	1,2-Dibromoethane (EDB)	2	35	1,2,4-Trichlorobenzene	20
15	1,2-Dichlorobenzene	2	36	1,1,1-Trichloroethane	2
16	1,3-Dichlorobenzene	2	37	1,1,2-Trichloroethane	2
17	1,4-Dichlorobenzene	2	38	Trichloroethene	2
18	Dichlorodifluoromethane	2	39	Trichlorofluoromethane	2
19	1,1-Dichloroethane	2	40	Vinyl acetate	10
20	1,2-Dichloroethane	2	41	Vinyl chloride	2
21	Trans-1,2-Dichloroethene	2	42	Xylenes (total)	2

7.2.8 Dioxins and Furans

Dioxins and furans will be analyzed in accordance with the analytical protocol taken from method SW-846 8080A. Table 7-12 presents the Appendix IX dioxin and furan reporting limits.

TABLE 7-12
Dioxins and Furans: Reporting Limits for SW-846 Method 8280A

	Analyte	Water RL (µg/L)	Soil RL (µg/kg)		Analyte	Water RL (µg/L)	Soil RL (µg/kg)
1	Total HxCDD	*	*	5	2,3,7,8-TCDD	0.00071	0.0001
2	Total HxCDF	*	*	6	Total TCDD	*	*
3	Total PeCDD	*	*	7	Total TCDF	*	*
4	Total PeCDF	*	*				

*The "total" reporting limits are a summation of the different peaks. The reporting limits are going to change from run to run. Each individual isomer can be detected to the sub part per trillion level, so the "total" reporting limits will usually be approximately 1 part per trillion. All raw data will be stored so that individual isomers can quantified if the project requests it.

7.2.9 Other Analyses to be Performed

The analyses listed in Tables 7-13 and 7-14 will be performed to the specifications of the designated methods and Quanterra's subcontract laboratory's QAP.

TABLE 7-13
Analyses for Geotechnical Parameters in Soil

Analysis	Method	Comments
Bulk Density	ASTM D2937	Assumes Shelby tube
Moisture Content	ASTM D2216	Low temperature drying method
Particle Size	ASTM D422	With #200 screen wash, may need more than 500mL if gravel diameter greater than .75 inch. Sieve method is used for >75µm particles, and hydrometer method is used for <75µm particles.
Vertical Hydraulic Conductivity	ASTM D5084 ASTM D2434	For cohesive/fine grained samples For loose/coarse grained samples

Note:
The reporting limit and level of precision vary by sample, for matrix effect impact sample results for geotechnical analyses. Most measurements can be made to a fraction of a percent.

TABLE 7-14
Reporting Limits for Other Analyses

Analysis	Method	Reporting Limit (µg/kg)
Soil		
Total Organic Carbon	Walkley-Black method	100,000
Water		**Reporting Limit (µg/L)**
Ammonia	USEPA 350.3	100
Carbon Dioxide	RSK 175	170
Methane	RSK 175	1.0
Hardness	USEPA 130.2	2,000
Total Phosphorous	USEPA 365.2	100
BOD	USEPA 405.1	2,000
COD	USEPA 410.4	10,000
Total Kjeldahl Nitrogen (TKN)	USEPA 351.3	1,000
Chloride	USEPA 300.0	1,000
Nitrate	USEPA 300.0	500
Nitrite	USEPA 300.0	500
Sulfate	USEPA 300.0	1,000
Sulfite	USEPA 377.1	2,000
Total and Dissolved Mn	USEPA SW846 Method 6010B	3.1
Total and Dissolved Iron	USEPA SW846 Method 6010B	200
Dissolved Ferrous Iron	3500 FE D	20
Dissolve Ferric Iron	3500 FE D	20
Total Dissolved Solids (TDS)	USEPA 160.1	10,000
Total Suspended Solids (TSS)	USEPA 160.2	4,000
pH	Field Measurement	0.1 pH unit
Conductivity	Field Measurement	—
Dissolved Oxygen	Field Measurement	—
Temperature	Field Measurement	—
Reduction Potential	Field Measurement	—

— = Not applicable

7.2.10 List of Associated Quality Control Samples

The analytical method references listed in Tables 7-2 through 7-14, above, include a QC section that addresses the minimum QC requirements for the analysis of specific analyte groups. Section 3 of this QAPP discusses the QC samples to collected and analyzed in support of this investigation and the estimated number of QC samples to be collected are summarized in Table 3-1.

8. Internal Quality Control Checks

8.1 Field Quality Control Checks

QC procedures for the field determinations will include calibrations and other procedures as described in the manufacturer instructions. The QC criteria for the field measurement are provided in their respective SOP. Assessment of field sampling precision and bias will be made by collecting field duplicates and field blanks for laboratory analysis. Collection of the samples will be in accordance with the applicable SOPs as referenced in Appendix C of the SAP.

8.2 Laboratory Quality Control Checks

Quanterra laboratory has a QC program in place to ensure the reliability and validity of the analysis performed at their laboratory. All analytical procedures are documented in writing as SOPs and each SOP includes a QC section that addresses the minimum QC requirements for the procedure. The internal QC checks differ slightly for each individual procedure but in general the QC requirements include the following:

- Method blanks
- Reagent/preparation blanks (applicable to inorganic analysis)
- Instrument blanks
- MS/MSDs
- Surrogate spikes
- Analytical spikes (Graphite furnace)
- Laboratory duplicates
- Laboratory control standards
- Internal standard areas for GC/1/4S analysis
- Mass tuning for GC/MS analysis
- Endrin/DDT degradation checks for GC/EC analysis
- Second, dissimilar column confirmation for GC/EC analysis

All data obtained will be properly recorded.

The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria.

9. Data Reduction, Review and Reporting

All data generated through field activities, or by the laboratory operation, shall be reduced and reviewed prior to reporting. No data shall be disseminated by the laboratory until it has been subjected to the procedures summarized in subsections below.

9.1 Data Reduction

9.1.1 Field Data Reduction Procedures

The field data will be written into field logbooks immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed, dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Later, when the results calculation forms required for this study are being filled out, the Field Team Leader, identified in Section 2 of this QAPP, will review the forms to determine whether any errors have been made by the field crew. If errors are noted, corrective action will be initiated.

9.1.2 Laboratory Data Reduction Procedures

Laboratory data reduction procedures will be performed in accordance with Section 8.8 of the Quanterra QAP.

9.2 Data Review

Data review procedures shall be performed for both field and laboratory operations as described below.

9.2.1 Procedures Used to Review Field Data

The Field Team Leader, under the supervision of the project chemist, will review the field analysis data. The field analyses are limited to ion selective electrode procedures. The data review will be initially limited to 10 percent of the field analytical data. This data will be reviewed to assess if the SOPs are being followed, for completeness, and if the measurements are of known precision and accuracy.

The data generated from other field (nonanalytical) data collection activities include surveying, water level measurement, and stratigraphic measurements, the collection and recording of this data will be reviewed by the Field Team Leader for completeness and comprehension, and for transcription accuracy.

If errors are noted in this level of review, the level of effort (LOE) will be expanded so the quality and usability of the field data can be fully assessed. The procedures to evaluate field data for this investigation include checking for transcription errors, review of field logbook data, and verifying calculations.

9.2.2 Procedures Used to Review Laboratory Data

Procedures to review laboratory data will be derived from the USEPA's Contract Laboratory Program, National Functional Guidelines For Organic Data Review, and Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review.

The quality control review will consist of, at a minimum, the following activities:

- Inventory the data package for completeness
- Check holding times for compliance with specified methods
- Review laboratory control sample result accuracy
- Review matrix spike/matrix spike duplicate result accuracy and precision
- Review field duplicate sample result precision
- Review method, equipment, field, and trip blank results for potential contaminants and the level of contamination

The level of review performed will be sufficient to obtain confidence in the quality and usability of the data. However, when errors are noted, a more detailed review will be performed and the data will be qualified as appropriate.

The data review approach is described in the Data Review SOP provided in the SAP, Appendix C. The purpose of the data review SOP is to maintain a degree of project consistency and data comparability across the life of the voluntary agreement. This SOP describes the data review process, the decision rules that could drive additional review, and how the process will be documented.

9.3 Data Reporting

Data reporting procedures shall be carried out for field and laboratory operations as indicated below.

9.3.1 Field Data Reporting

Field analytical data reporting shall be conducted principally through the transmission of report sheets containing tabulated results of all measurements made in the field, and documentation of all field calibration activities in the field logbooks.

The data generated from other field (nonanalytical) data collection activities include surveying, water level measurement, and stratigraphic measurement and will be recorded in accordance with the SOPs provided in Appendix C of the SAP.

Sample labels and COCs are generated through the database and provided to the field team before samples are collected. COC records are completed and signed by the sampler and accompany the sample bottles in the cooler shipped to the laboratory. Copies of the COC records are placed into the project files and used to track work received from the laboratory.

9.3.2 Laboratory Data Reporting

During the laboratory data acquisition activity, the laboratory performs the sample analyses and generates hard copy analytical reports and associated electronic data deliverables. The

laboratory's Project Manager verifies hard copy and electronic deliverables. The hard copy and electronic reports must match the requested sample analyses.

Quanterra will provide a hard copy of the data report to the project chemist. The copy supplied to CH2M HILL will be unbound for data quality review and evaluation. The copy supplied to Hoover will be an electronic copy of the hard copy, for archiving. The data will be in the Contract Laboratory Program format to ease the data quality review and evaluation effort.

Electronic copies will be provided to The Hoover Company and the CH2M HILL project team.

The hardcopy deliverable format will consist of all raw data assembled as described below:

1. Table of Contents
2. Case Narrative
3. Sample Description/Laboratory ID and Client ID Cross Reference
4. Explanation of Abbreviations
5. Analytical Tests Requested by Sample
6. Analytical Results
7. QC Summaries
8. Chain-of-Custody Forms
9. Miscellaneous (FedEx receipts, invoices, sample receipt form, etc.)
10. Volatile GC/MS Supporting Documentation/Raw Data
11. Volatile GC Supporting Documentation/Raw Data
12. LC/MS Supporting Documentation/Raw Data, as required)
13. Metals Supporting Documentation/Raw Data
14. General Chemistry Supporting Documentation/Raw Data
15. Subcontracted Results

The format for the electronic data will be as specified in the laboratories Analytical Statement of Work.

9.4 Data Management, Security, Documentation, and Presentation

Data gathered during the site investigation activities will be compiled into a project environmental database system that can be used to evaluate site conditions and data trends. The data management effort is summarized below and described in detail in the project-specific Data Management Plan.

9.4.1 Data Management

Data management for The Hoover Company program has the following objectives:

- Establish a controlled, functional, and efficiently operated data management system and accompanying procedures to manage, analyze, document, and transfer the environmental data collected and generated in support of the investigation and corrective action activities

- Maintain a usable and accurate database throughout the life of the project
- Process specific data requests in support of the investigation and corrective action activities
- Transfer the database or specific data components to other parties, as appropriate
- Archive the database and related documentation upon project closeout

Measurements made during field data collection activities will be recorded in field logbooks. Field data will be reduced, summarized, and stored with the field logbooks. Field logbooks and all other hardcopies of logs will be photocopied daily and archived to maintain data integrity. Electronic field data (COCs, boring logs, etc.) will be stored in the database, and printed out and filed.

All raw analytical laboratory data are stored as original hard copy. Hard copy information includes COC forms, raw data, certificates of analyses, and QA/QC report summaries.

9.4.1.1 Data Input Procedures

Sampling information, analytical results, applicable QA/QC data, and data review qualifiers will be entered into an environmental database for storage and retrieval during data evaluation and report development. The data will be electronically entered into the database from files received from the analytical laboratory. The data entry will be checked by printing out data reports, and manually comparing them to the reviewed summary analytical forms received from Quanterra.

9.4.1.2 Computer Database

The computer database system uses structured query language (SQL) combined with a macro-programming language and software tools for building menus, on-line forms, and report formats. The database will be based on a relational model, in which independent tables containing fields of data can be linked through selected fields that are common to two or more tables. This database design allows inclusion of historical data. It also allows users to effectively conduct trend analysis and generate a variety of data reports that aid data interpretation and report generation.

9.4.2 Access and Security

The database must be protected from unauthorized access, tampering, accidental deletions or additions, and data or program loss that can result from power outages or hardware failure. The following procedures will be adopted to ensure this protection:

- A copy of the master database will be stored on the local area network (LAN) file server and protected with file passwords known only to the Data Administrator. The Data Administrator is the only person who will be authorized to modify the master database.
- The master database will be archived onto CD-ROM and stored at a secure location. The disks will be backed up whenever changes are made to the master database. Before archiving, if necessary, the data will be compressed to reduce storage using the PKZIP utility from PKWARE, Inc.

- A copy of the master database will be placed on the LAN under a directory with limited "read only" access rights to users, which will permit readers to only copy or view the data. Whenever the master database is modified, it will be recopied to the LAN to ensure that the current copy is available to users.

The LAN copy of the master database will be backed up through the standard LAN backup procedures that are administered by the Regional Computer Center support staff. Backups will occur each day.

9.4.3 Documentation

Documentation of data management activities is critical because it provides:

- A hard copy record of project data management activities
- Reference information critical for database users
- Evidence that the activities have been properly planned, executed, and verified
- Continuity of data management operations when personnel changes occur

Additional documentation will also be maintained to document specific issues such as database structure definitions, database inventories, database maintenance, user requests, database issues and problems, and client contact.

9.4.4 Evidence File

The final evidence file in CH2M HILL's Dayton office will be the central location for all documents that constitute evidence relevant to sampling and analysis activities. CH2M HILL will be the custodian of the evidence file. It will maintain the contents of the evidence filesthrough the duration of the program, including all relevant records, reports, logs, field notebooks, pictures, subcontractor reports, and data reviews in a secured, limited access area under the custody of CH2M HILL.

CH2M HILL will keep all records until program completion and closeout. As necessary, records may be transferred to an offsite records storage facility. The records storage facility must provide secure, access controlled storage of records. Records of raw analytical laboratory data, quality assurance data, and reports will be kept by the subcontract laboratory for at least 6 years.

9.4.5 Presentation of Site Characterization Data

Depending on the data user needs, data presentation may consist of such formats as:

- Spreadsheet presentations of data summaries or raw data
- Tables providing statistical evaluation results or calculation results
- Presentation tools such as ARCINFO or other similar analysis/presentation aids
- Figures showing concentration contours, location-specific concentrations, or other visual display of analytical results relative to project-specific target screening levels

10. Performance and System Audits and Frequency

Performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analysis are performed in accordance with the procedures established in the SAP and QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

10.1 Field Performance and System Audits

Field performance and system audits are summarized below and described in detail in the Field Performance and System Audit SOP provided in the SAP, Appendix C. This SOP will discuss how the audit will be performed, how the audit results will be documented, and potential corrective actions.

10.1.1 Internal Field Audits

10.1.1.1 Internal Field Audit Responsibilities

Internal audits of field activities including sampling and field measurements will be conducted by the CH2M HILL's Field Team Leader and Project Manager. These audits will verify that all established procedures are being followed.

10.1.1.2 Internal Field Audit Frequency

Internal field audits will be conducted by CH2M HILL's Project Manager at least once at the beginning and in the middle of the site sample collection activities. Day to day field inspections will be completed by CH2M HILL's Field Team Leader.

10.1.1.3 Internal Field Audit Procedures

The audits will include examination of field sampling records, field analytical results, field instrument operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, etc. Follow-up audits will be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the investigation.

10.1.2 External Field Audits

10.1.2.1 External Field Audit Responsibilities

External field audits may be conducted by the USEPA RCRA Project Manager.

10.1.2.2 External Field Audit Frequency

External field audits may be conducted any time during the field operations. These audits may or may not be announced and are at the discretion of USEPA.

10.1.2.3 External Field Audit Process

External field audits will be conducted according to the field activity information presented in the QAPP. The external field audit process can include (but not be limited to): sampling equipment decontamination procedures; sample bottle preparation procedures; sampling procedures; examination of field sampling and safety plans; sample vessel cleanliness and QA procedures; procedures for verification of field duplicates; sample preservation and preparation for shipment; as well as field screening practices.

10.2 Laboratory Performance and Systems Audits

10.2.1 Internal Laboratory Audits

10.2.1.1 Internal Laboratory Audit Responsibilities

The Quanterra QA Officer will conduct the internal laboratory audit.

Internal audits of Quanterra laboratories are performed to assess the degree of adherence to established policies, procedures, and standards.

These assessments are conducted internally by Quanterra personnel who are independent of the area being evaluated, and externally by clients and regulatory agencies. Audits can identify areas for improvement with regard to compliance with policies, procedures, and standards. Audits also provide a means for correction prior to system failure.

10.2.1.2 Internal Laboratory Audit Frequency

Internal systems audits or evaluations are conducted at least yearly by QA staff external to the lab. Spot assessments are conducted per schedule by the laboratory QA group.

10.2.1.3 Internal Laboratory Audit Procedures

Internal systems audits or evaluations are generally conducted by QA staff, although periodic self-audits may be conducted by the operational units. Audits and assessments are generally conducted through the use of checklists and appropriate reference documents. Internal systems audits or evaluations are conducted with an opening meeting in which representatives from management, key operational staff, and QA staff participate. The opening meeting provides a review of objectives and the schedule required to conduct the audit. At the completion of the audit, a debriefing is held to outline the findings, including identification of positive performance, to discuss requirements in areas of deficiencies, and to answer questions. Spot assessments are generally more informal than systems audits, and may be conducted without prior scheduling.

The findings of all audits and assessments are documented, as are the laboratory response and any corrective actions. Follow-up checks are performed and the status of implementation of corrective actions is documented for all categories of audits and assessments. This cycle continues until all issues are closed.

10.2.2 External Laboratory Audits

10.2.2.1 External Laboratory Audit Responsibilities

An external audit will be conducted on Quanterra's North Canton Laboratory by CH2M HILL's Project Chemist prior to the initiation of site sample collection activities. The purpose of this audit will be to assess if the laboratory has the standard operation procedures in place to be able to successfully complete the RFI.

An external audit may be conducted as required, by appropriate QA staff of the Waste, Pesticides and Toxics Division, USEPA Region V.

10.2.2.2 External Laboratory Audit Frequency

An external audit will be conducted at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced and are at the discretion of the USEPA.

10.2.2.3 Overview of the External Laboratory Audit Process

External audits may include any or all reviews of laboratory analytical procedures, site visits, and/or submission of performance evaluation samples to the laboratory for analysis. Failure of any or all audit procedures chosen can lead to laboratory disqualification, and the requirement that another suitable laboratory be chosen.

An external audit can consist of the following:

- Security and log in procedures
- Sample through put tracking procedure
- Review of instrument calibration records, instrument logs, and statistics (number and type)
- Review of QA procedures, logbooks, sample prep procedures
- Sample analytical SOP review
- Instrument (normal or extends quantitation report) reviews
- Personnel interviews
- Review of deadlines and glassware preparation
- Closeout to offer potential corrective action.

It is common practice when conducting an external laboratory audit to review one or more data packages from sample lots recently analyzed by the laboratory. This review will most likely include but not be limited to:

- Comparison of resulting data to the SOP or method, including coding for deviations
- Verification of initial and continuing calibrations within control limits
- Verification of surrogate recoveries and instrument timing results where applicable

- Review of extended quantitation reports for comparisons of library spectra to instrument spectra, where applicable
- Recoveries on control standard runs
- Review of run logs with run times, ensuring proper order of runs
- Review of spike recoveries/QC sample data
- Review of suspected manually integrated GC data and its cause (where applicable)
- Review of gas chromatograph peak resolution for isolated compounds as compared to reference spectra (where applicable)
- Assurance that samples are ran within holding times

Ideally, the data should be reviewed while on the premises, so that any data called into question can be discussed with the staff.

11. Preventive Maintenance

11.1 Field Instrument Preventive Maintenance

Field equipment testing, inspection, and maintenance will be in accordance with the SOPs in the SAP. Critical spare parts such as tape and batteries will be kept onsite to reduce potential downtime. Backup instruments/parts will be maintained on site or within 1-day shipment to minimize delays in the field schedule.

11.2 Laboratory Instrument Preventive Maintenance

The primary purpose of the maintenance program is to prevent instrument and equipment failure and to minimize down time. A properly implemented maintenance program increases the reliability of a measurement system.

Each instrument or piece of equipment shall be uniquely identified. Each operating unit shall maintain the following:

- Instrument/equipment inventory list
- Instrument/equipment major spare parts list or inventory
- External service agreement documents (if applicable)
- Instrument-specific preventive maintenance logbook or file for each functional unit

The records of routine maintenance and non-routine maintenance shall include at a minimum:

- Name and serial number of the item or equipment
- Details of maintenance performed
- Dates and results of recalibrations/reverifications indicating back to control
- Analyst initials and the date maintenance was performed whether by the analyst or a contracted service representative

Any item or equipment that does not perform to specifications or defective shall be taken out of service, clearly identified and segregated until it has been repaired and shown by calibration/verification to perform satisfactorily.

Quanterra's QAP documents and describes in detail instrument and equipment preventive maintenance procedures and requirements.

The frequency of maintenance must consider manufacturer's recommendations and previous experience.

11.3 Inspection / Acceptance Requirements for Supplies and Consumables

Critical supplies will be inspected upon receipt and accepted only if they are of acceptable (complete, intact, not expired, etc...) quality.

Field analytical reagents and standards will labeled with the following information on acceptance:

- Date received
- Date tested (if performed)
- Date to be retested (if applicable)
- Expiration date (if applicable)

12. Specific Routine Procedures Used to Evaluate Data Precision, Accuracy, and Completeness

The purpose of this section is to indicate the methods by which it will be ensured that the data collected for this investigation falls in line with the data quality objectives (DQOs) for the site.

The analytical data quality will be assessed to determine if the objectives have been met. In addition, the data will be reviewed for indications of interferences to results caused by sample matrices, cross contamination during sampling, cross contamination in the laboratory, and sample preservation and storage anomalies (i.e., samples holding time or analytical instrument problems).

12.1 Accuracy Assessment

In order to assure the accuracy of the analytical procedures, an environmental sample shall be spiked with a known amount of the analytes. The increase in concentration of the analyte observed in the spiked sample, due to the addition of a known quantity of the analyte, compared to the reported value of the same analyte in the unspiked sample, determines the percent recovery.

Accuracy is similarly assessed by determining percent recoveries for internal standards and surrogate compounds added to each field and QC sample. Accuracy for the metals analysis will also be further assessed through determination of percent recoveries for laboratory control samples (as well as MS samples).

Percent recovery for MS/MSD results is determined according to the following equation:

$$\% R = \frac{(\text{Amount in Spiked Sample} - \text{Amount in Sample})}{\text{Known Amount Added}} \times 100$$

Percent recovery for LCS and surrogate compound results is determined according to the following equation:

$$\% R = \frac{\text{Experimental Concentration}}{\text{Known Amount Added}} \times 100$$

12.2 Precision Assessment

The relative percent difference (RPD) between the spike and matrix spike, or matrix spike and sample duplicate in the case of metals, and field duplicate pair or laboratory duplicate pair is calculated to compare to precision DQOs and plotted. The RPD is calculated according to the following formula:

$$RPD = \frac{(\text{Amount in Sample 1 - Amount in Sample 2})}{0.5(\text{Amount is Sample 1 + Amount in Sample 2})} \times 100$$

12.3 Completeness Assessment

Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. Following completion of the analytical testing, the percent completeness will be calculated by the following equation:

$$\text{Completeness} = \frac{(\text{number of valid measurements})}{(\text{number of measurements planned})} \times 100$$

12.4 Assessment of Data

The field and laboratory data collected during this investigation will be used to evaluate the nature and extent of contamination at the site. The QC results associated with each analytical parameter for each matrix will be compared to the objectives presented in Section 3 of this QAPP. Only data generated in association with QC results meeting these objectives will be considered useable for decision-making purposes.

Factors to be considered in the assessment of field and laboratory data may include, but not necessarily be limited to, the following:

- Were all samples obtained using the methodologies and SOPs proposed in the QAPP?
- Were all proposed analyses performed according to Quanterra's Laboratory QAP?
- Were samples obtained from all proposed sampling locations and depths?
- Do any analytical results exhibit elevated detection limits due to matrix interferences or contaminants present at high concentrations?
- Were all field and laboratory data reviewed according to the protocols, including project-specific QC objectives, proposed in the QAPP?
- Which data sets were found to be unusable (qualified as "R") based on the data review results?
- For any cases where the proposed procedures and/or requirements have not been met, has the affect of these issues on the project objectives been evaluated?
- Based on the overall findings of the investigation and this assessment, were the original project objectives appropriately defined? If not, have revised project objectives been developed?

13. Corrective Action

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out of QC performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data review, and data assessment. All corrective action proposed and implemented should be documented in QA reports to management. Corrective action should only be implemented after approval by The Hoover Company Project Manager or their designee. If immediate corrective action is required, approvals may be secured by telephone from The Hoover Company Project Manager.

For noncompliance problems, a formal corrective action program will be determined and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying their project manager. If the problem effects the project schedule, the USEPA RCRA Project Manager will be notified.

13.1 Field Corrective Action

Any project team member may initiate a field corrective action process. The corrective action process consists of identifying a problem, acting to eliminate the problem, monitoring the effectiveness of the corrective action, verifying that the problem has been eliminated, and documenting the corrective action.

Field corrective actions include correcting COC forms, problems associated with sample collection, packaging, shipping, field record keeping, or additional training in sampling and analysis. Additional approaches may include resampling or evaluating and amending sampling procedures. The FTL will summarize the problem, establish possible causes, and designate the person responsible for a corrective action. The FTL will verify that the initial action has been taken and that it appears to be effective, and will additionally follow up at a later date to verify that the problem has been resolved.

13.2 Laboratory Corrective Action

Corrective actions are measures taken to rectify conditions adverse to quality and, where possible, to prevent their reoccurrence. Corrective actions should be timely, determine the root cause, and evaluate any propagation of the error or problem. Whenever a systematic error is discovered that affects the accuracy or defensibility of results reported to Quanterra's clients, client notification will be part of the corrective action. Corrective actions should be implemented with an understanding of the technology and work activities associated with the quality element, with appropriate training of Quanterra associates and vendors, and should be monitored for progress and success.

Depending on the nature of the problem, the corrective action employed may be formal or informal. In either case, occurrence of the problem, the corrective action employed, and verification that the problem has been eliminated must be documented properly.

On-the-spot actions are used to correct minor problems, such as recalibration, retuning, a minor repair (e.g., replacement of a minor part) of a malfunctioning instrument, or the correction of poor analytical technique being used by an analyst. These occurrences are documented in the appropriate injection, run, or analysis logbooks. Similarly, routine instrument maintenance, malfunctions, and power failures are also documented in the appropriate instrument maintenance logbooks. These events do not require a formal Non-Conformance Memo process. Corrective actions specific to analytical methods are discussed in the operational-specific SOPs provided in Quanterra's Laboratory QAP.

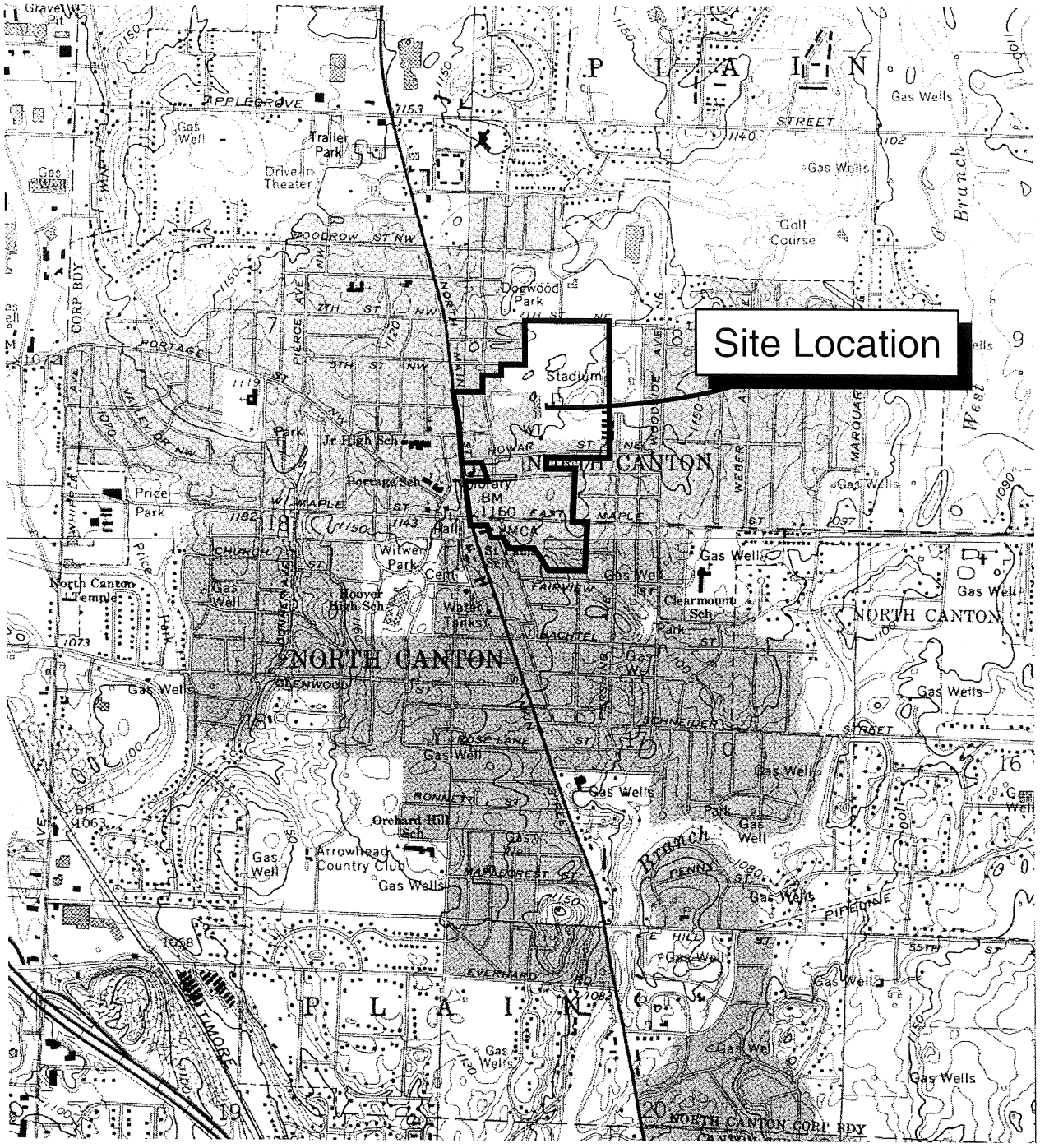
13.3 Corrective Action During Data Review and Data Assessment

The facility may identify the need for corrective action during either the data review or data assessment. Potential types of corrective action may include resampling by the field team or reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team and whether the data to be collected is necessary to meet the required QA objectives (e.g., the holding time for samples is not exceeded, etc.). If the CH2M HILL data assessor identifies a corrective action situation, it is The Hoover Company Project Manager who will be responsible for approving the implementation of corrective action, including resampling.

14. Quality Assurance Reports to Management

Data quality will be summarized, as directed by the Voluntary Corrective Action Agreement, in the quarterly project status reports. These reports will be written by CH2M HILL and distributed to the project team. These reports will contain a separate QA section that may include a discussion on the accuracy, precision, and completeness of the data as well as the results of the performance and system audits, and any corrective action needed or taken during the project.



APPROXIMATE SCALE

0 1/2 1

Miles

NORTH

LEGEND

Hoover Facility Detailed on Figure 2-2

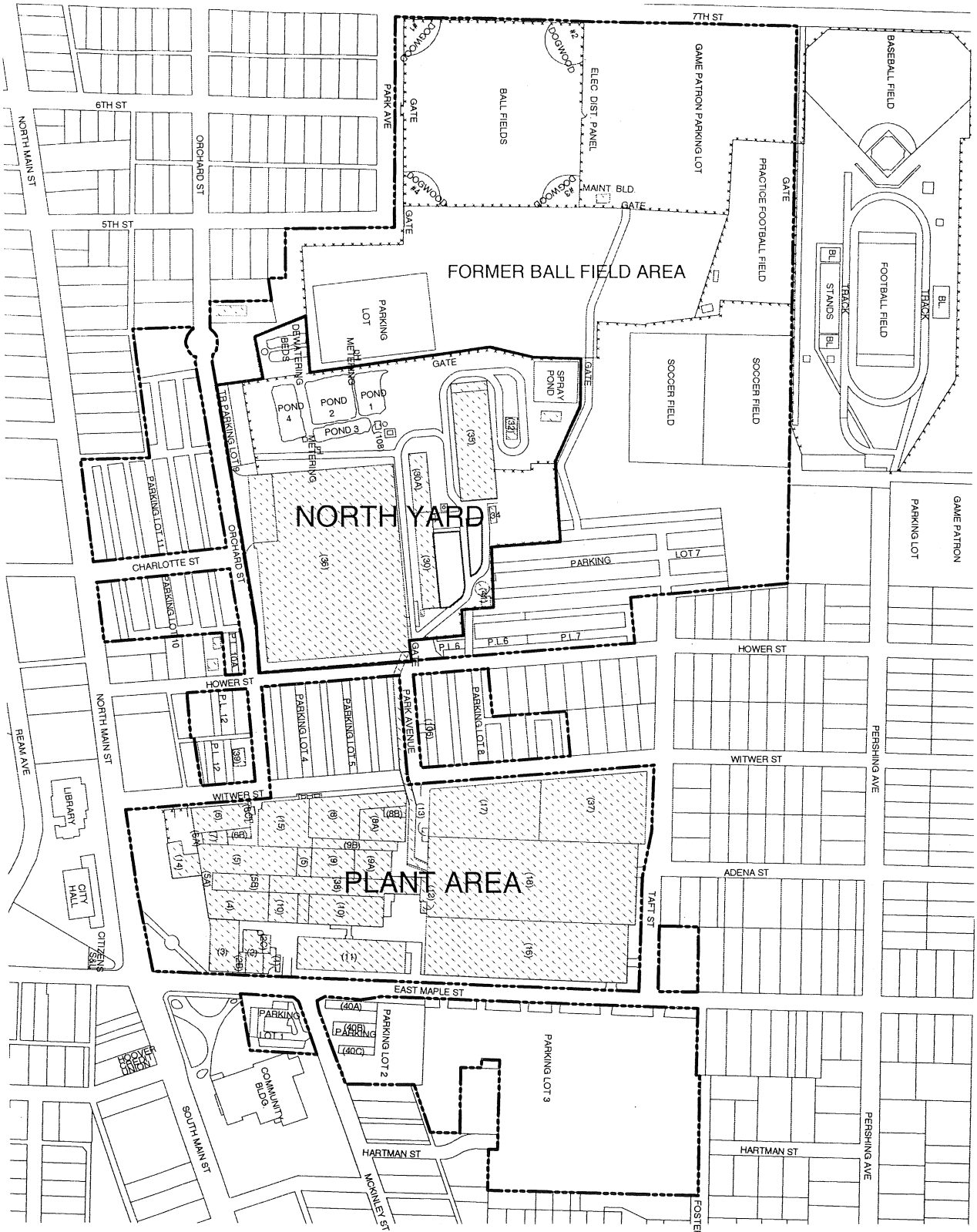
NOTE

Base map adapted from US Geological Survey 7.5 Minute Quandrangle Maps: Canton West, Ohio (revised in 1985) and North Canton, Ohio (revised in 1984).

FIGURE 1-1

Site Location Map

Perimeter Investigation QAPP
The Hoover Company, North Canton, Ohio



LEGEND

(36) Hoover building location and number

Hoover property boundary

North Yard extent

North

0 200 400 600 800

Map scale: 1 inch = 400 feet

NOTES

1. Base map provided by Hoover Engineering (April 1997).

FIGURE 1-2

Plant 1 Site Plan

PERIMETER INVESTIGATION QUALITY ASSURANCE PROJECT PLAN
THE HOOVER COMPANY, NORTH CANTON, OHIO

CH2MHILL

LEGEND

- Material and Waste Management Units
- REGULATED UNIT
- Approximate Property Boundary
- Piping Location
- Assumed Location of Piping, Actual Location Unknown

NOTE: Designation for Production Waste Management Areas are from the Material and Waste Management Areas Inventory - CH2M HILL 1997

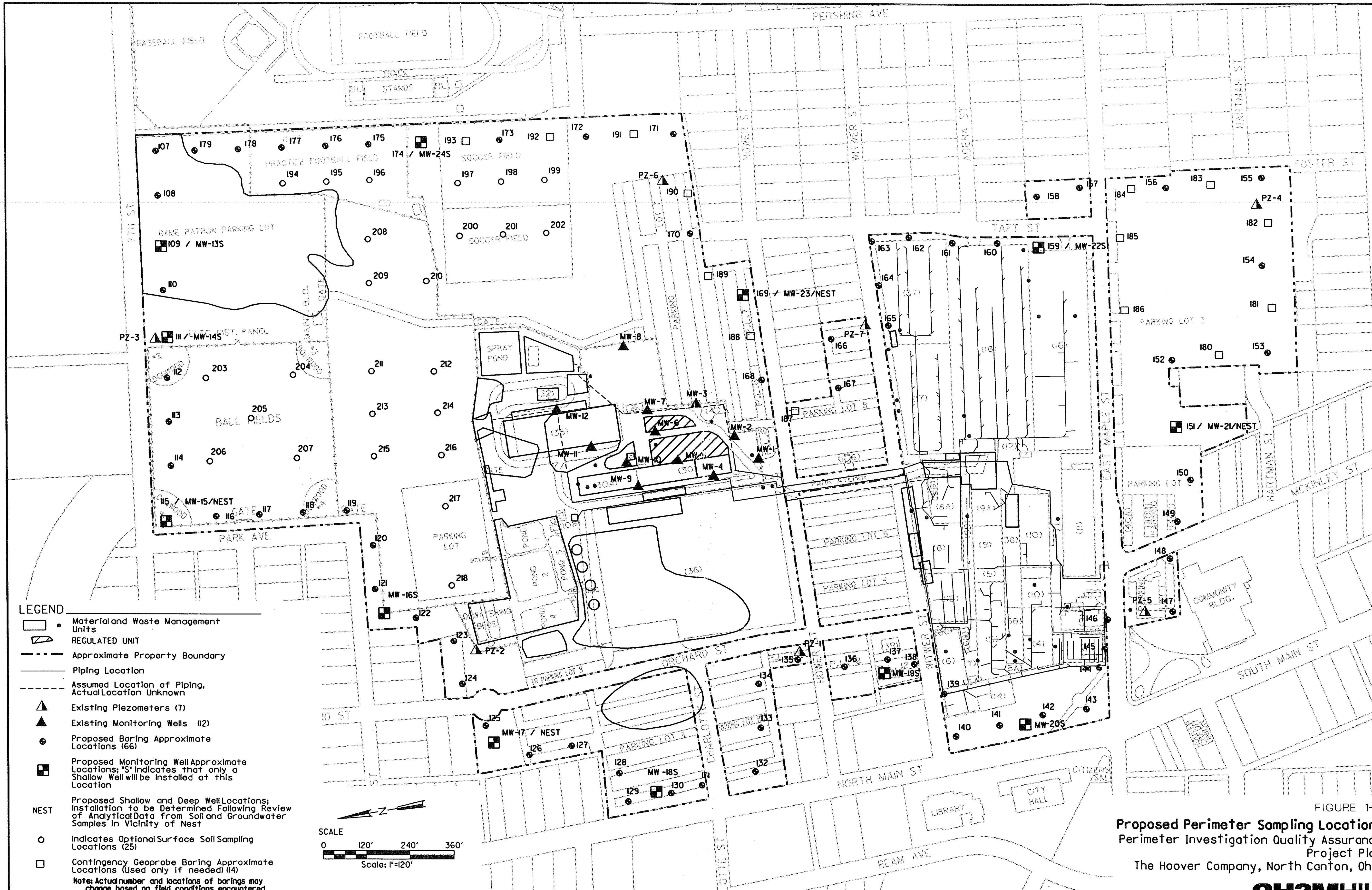
FIGURE 1-3

MATERIAL AND WASTE MANAGEMENT UNIT LOCATIONS

Perimeter Investigation Quality Assurance Project Plan
The Hoover Company, North Canton, Ohio

CH2MHILL

148304a.dgn View: QAPP13
03-FEB-2000



LEGEND

- Material and Waste Management Units
- REGULATED UNIT
- Approximate Property Boundary
- Piping Location
- Assumed Location of Piping, Actual Location Unknown
- Existing Piezometers (7)
- Existing Monitoring Wells (12)
- Proposed Boring Approximate Locations (66)
- Proposed Monitoring Well Approximate Locations; "S" indicates that only a Shallow Well will be installed at this Location
- NEST — Proposed Shallow and Deep Well Locations; Installation to be Determined Following Review of Analytical Data from Soil and Groundwater Samples in Vicinity of Nest
- Indicates Optional Surface Soil Sampling Locations (25)
- Contingency Geoprobe Boring Approximate Locations (Used only if needed) (14)

Note: Actual number and locations of borings may change based on field conditions encountered.

FIGURE 1-4

Proposed Perimeter Sampling Locations

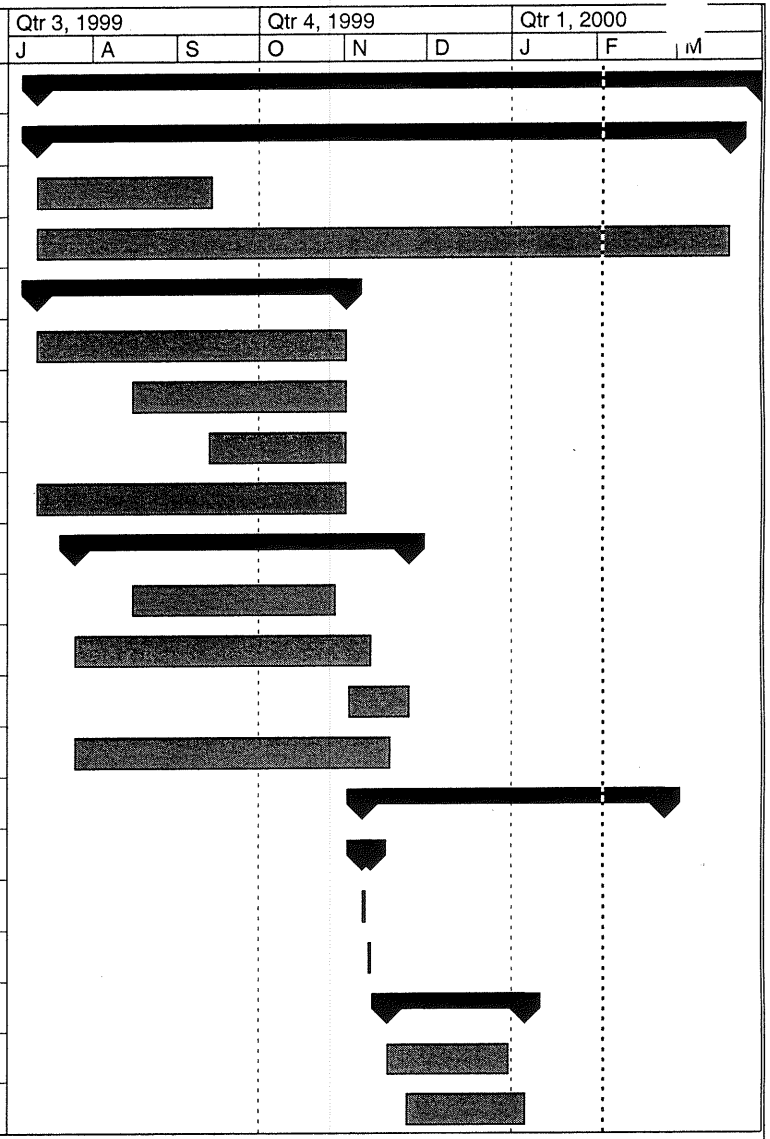
Perimeter Investigation Quality Assurance Project Plan

The Hoover Company, North Canton, Ohio

CH2MHILL

QAPP 1-4 148304.dgn Antigone/Hoover/155441 VCA Project/Cad
03-FEB-2000

ID	Task Name	Duration	Start	Finish
1	**A2 - Perimeter Surface & Soils**	**190 days**	**Mon 07/12/99**	**Fri 03/31/00**
2	**.PL - Planning**	**181 days**	**Mon 07/12/99**	**Mon 03/20/00**
3	.01 Strategy	46 days	Mon 07/12/99	Mon 09/13/99
4	.02 - Meetings	181 days	Mon 07/12/99	Mon 03/20/00
5	**.03 - Workplan Preparation**	**81 days**	**Mon 07/12/99**	**Mon 11/01/99**
6	Workplan	81 days	Mon 07/12/99	Mon 11/01/99
7	SAP	56 days	Mon 08/16/99	Mon 11/01/99
8	QAPP/SOW	36 days	Mon 09/13/99	Mon 11/01/99
9	H&S Plan	81 days	Mon 07/12/99	Mon 11/01/99
10	**.04 - Subcontracting**	**88 days**	**Mon 07/26/99**	**Wed 11/24/99**
11	Trailers	54 days	Mon 08/16/99	Thu 10/28/99
12	Drilling	78 days	Mon 07/26/99	Wed 11/10/99
13	Mapping	16 days	Wed 11/03/99	Wed 11/24/99
14	Surveying	83 days	Mon 07/26/99	Wed 11/17/99
15	**.IP - Implementation**	**80 days**	**Mon 11/08/99**	**Fri 02/25/00**
16	**.01 - Pre-Fieldwork, Mobilization & Site Prep.**	**3 days**	**Mon 11/08/99**	**Wed 11/10/99**
17	Utility Clearance	1 day	Mon 11/08/99	Mon 11/08/99
18	Site Visit	1 day	Wed 11/10/99	Wed 11/10/99
19	**.02 - Surveying**	**36 days**	**Wed 11/17/99**	**Wed 01/05/00**
20	Surveying	32 days	Wed 11/17/99	Thu 12/30/99
21	Photomapping	31 days	Wed 11/24/99	Wed 01/05/00



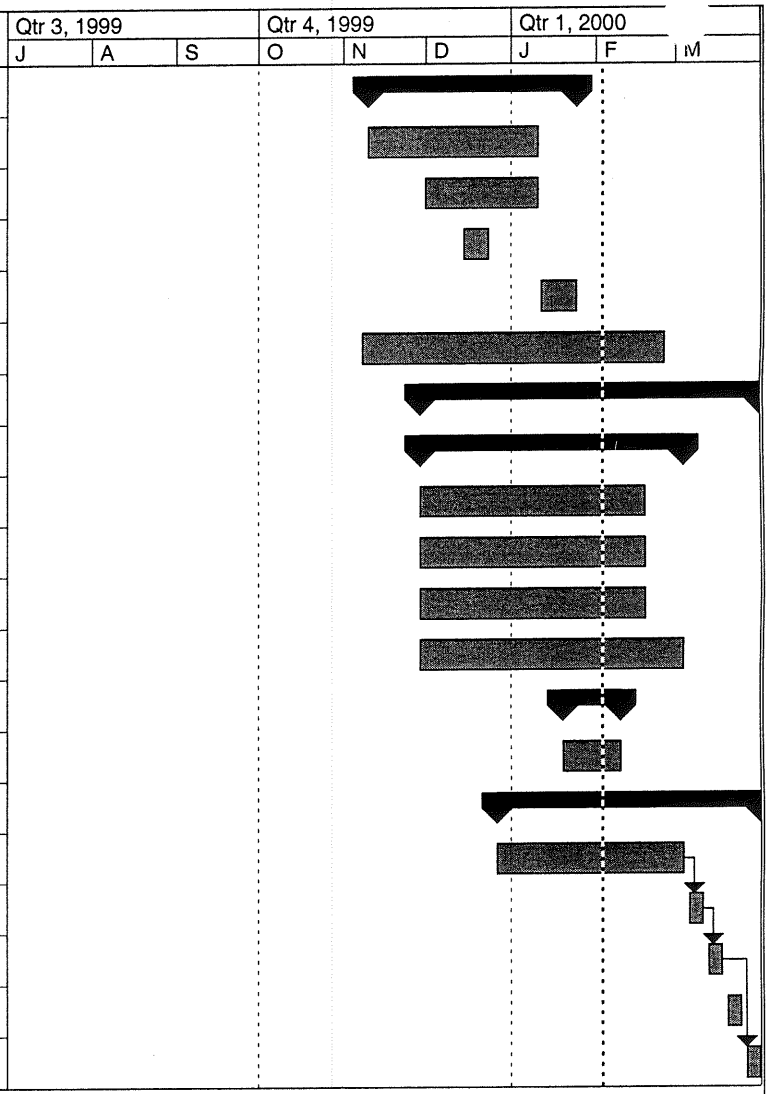
Project: HOOVERsched
Date: Thu 02/03/00

Task
Split
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Split
Rolled Up Milestone
Rolled Up Progress
External Tasks
Project Summary

[Antigone] J:\Hoover\#155441-VCA Project\(A)\{2}\{IP}\{03}\Schedule\HOOVERsched_QAPP.mpp

Figure 1-5
Perimeter Investigation Schedule
The Hoover Company, North Canton, Ohio

ID	Task Name	Duration	Start	Finish
22	**.03 - Sampling**	**54 days**	**Wed 11/10/99**	**Mon 01/24/00**
23	Perimeter Sampling	44 days	Wed 11/10/99	Mon 01/10/00
24	Monitoring Well Installation	29 days	Wed 12/01/99	Mon 01/10/00
25	Contingency Surf. Soil & Perimeter Sampling	7 days	Wed 12/15/99	Thu 12/23/99
26	Monitoring Well Sampling & Testing	9 days	Wed 01/12/00	Mon 01/24/00
27	.04 - Subcontract Management	80 days	Mon 11/08/99	Fri 02/25/00
28	**.ER - Evaluation & Reporting**	**90 days**	**Mon 11/29/99**	**Fri 03/31/00**
29	**.01 - Data Management & Visualization**	**70 days**	**Mon 11/29/99**	**Fri 03/03/00**
30	Data Evaluation	60 days	Mon 11/29/99	Fri 02/18/00
31	Data Analysis	60 days	Mon 11/29/99	Fri 02/18/00
32	QA/QC	60 days	Mon 11/29/99	Fri 02/18/00
33	Data Visualization/GIS	70 days	Mon 11/29/99	Fri 03/03/00
34	**.02 - Risk Evaluation**	**15 days**	**Thu 01/20/00**	**Wed 02/09/00**
35	Human Health	15 days	Thu 01/20/00	Wed 02/09/00
36	**.03 - Report Prep.**	**70 days**	**Mon 12/27/99**	**Fri 03/31/00**
37	Internal Draft	50 days	Mon 12/27/99	Fri 03/03/00
38	Internal Review	5 days	Mon 03/06/00	Fri 03/10/00
39	Client Draft	5 days	Mon 03/13/00	Fri 03/17/00
40	Client Review	5 days	Mon 03/20/00	Fri 03/24/00
41	Final Report	5 days	Mon 03/27/00	Fri 03/31/00



Project: HOOVERsched
Date: Thu 02/03/00

Task
Split
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Split
Rolled Up Milestone
Rolled Up Progress
External Tasks
Project Summary

[Antigone] J:\Hoover\#155441-VCA Project\(A)\{2}\{IP}\{03}\Schedule\HOOVERsched_QAPP.mpp

Figure 1-5
Perimeter Investigation Schedule
The Hoover Company, North Canton, Ohio

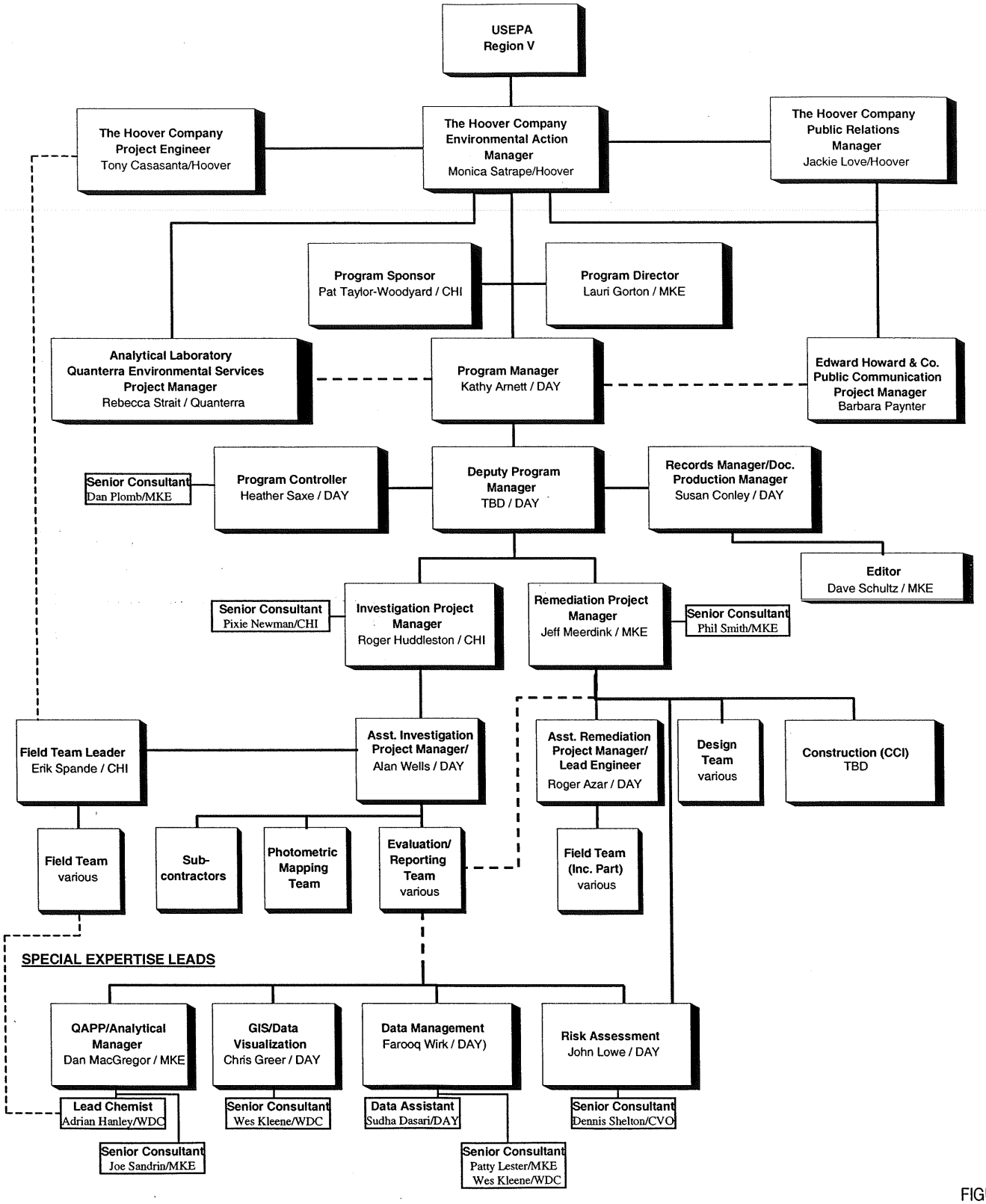


FIGURE 2-1

Hoover VCA Program Management Structure

The Hoover Company, North Canton, Ohio

CH2MHILL